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Chemical Engineering

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A GREATLY INCREASED flow of Geon polyvinyl chloride resins and other plastic compounds will soon be coming from B. F. Goodrich Chemical Company's plant at Avon Lake, Ohio. Girdler—who engineered and constructed existing facilities—will act as general contractor for the expanded processing plant.

The plastic resins which are produced here are the raw materials for an ever-increasing number of products ranging from plastic pipe to Army ponchos, from truck tarpaulins to circus tents.

Naturally, Girdler feels proud of being entrusted with responsibility for this expansion project. It's a good indication that our experience and ability pay off in performance. Keep this in mind when *you* plan process plant expansion or modernization and take advantage of our *complete* service and vast experience, too. Call or write for complete information.

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OCTOBER 1956

JOHN R. CALLAHAM

Special: Protective Linings

Next month we'll bring you—as the feature of our 17th Biennial Report on Materials of Construction—a special, 22-page article on protective lining systems for chemical processing equipment.

This article is the most comprehensive guide to the proper use of organic protective linings in today's chemical engineering literature. It is, in fact, a "first" in the field.

Typical of the topics covered in this article: When to use a lining, what type to use, thick linings vs thin linings, organic vs metallic, influence of equipment design, how to modify existing equipment for longer life, tips on surface preparation, how to test and inspect, safety measures, cost factors to watch.

Economic life of today's process equipment depends to no small degree on the proper choice and use of the protective lining system.

For this reason, we are proud to publish this special article and thereby to do our share of pioneering in a field that's bound to grow in both process and dollar importance.

Second part of our 17th Biennial Report on Materials of Construction—a series we started back in 1923—is our much-used Directory of Construction Materials.

This 12-page Directory is an up-to-date tally of who makes what materials. It includes trade names, forms available, end uses in processing equipment.

After you've read our November special report, let us know what you think of it. Your reactions will help us in planning future reports.

GUIDED TOUR

How to use foams and how to combat the problems of foaming

Because many engineers know too little about foams, this month's CE Report gives a three-way look at the problems. It tells what foams really are and why they behave as they do. It describes how to kill troublesome ones. It outlines methods for putting useful ones to work. (p. 173)

The membrane process today

There are a number of plants already using the electric membrane process to make fresh water from salt water. Here's how the process now stands in terms of operation, maintenance and costs. (p. 185)

Eight-way design checklist

New checklist of design trouble spots will eliminate hindsight. Your answers to our

Please turn page

Chemical Engineering

OCTOBER 1956

GUIDED TOUR

47 questions will help avoid maintenance headaches and wasted dollars that bad design always brings. (p. 190)

Novelty on a commercial scale

How engineering ingenuity beats the many and complex problems met in large-scale atomics. Chemical engineers will meet these problems oftener as nuclear power and processing become more widespread. (p. 195)

Right way to limit pump flow

An easy and sure way to get regulated flow from centrifugal pumps is to put an orifice in the line. Here's a step-by-step guide to two methods—field and office—for picking the right sizes. (p. 199)

Practical new calculation method

With this improved method you'll get accurate design information for compressors; even with inadequate thermodynamic data. And it takes into account those deviations from the ideal gas law. (p. 204)

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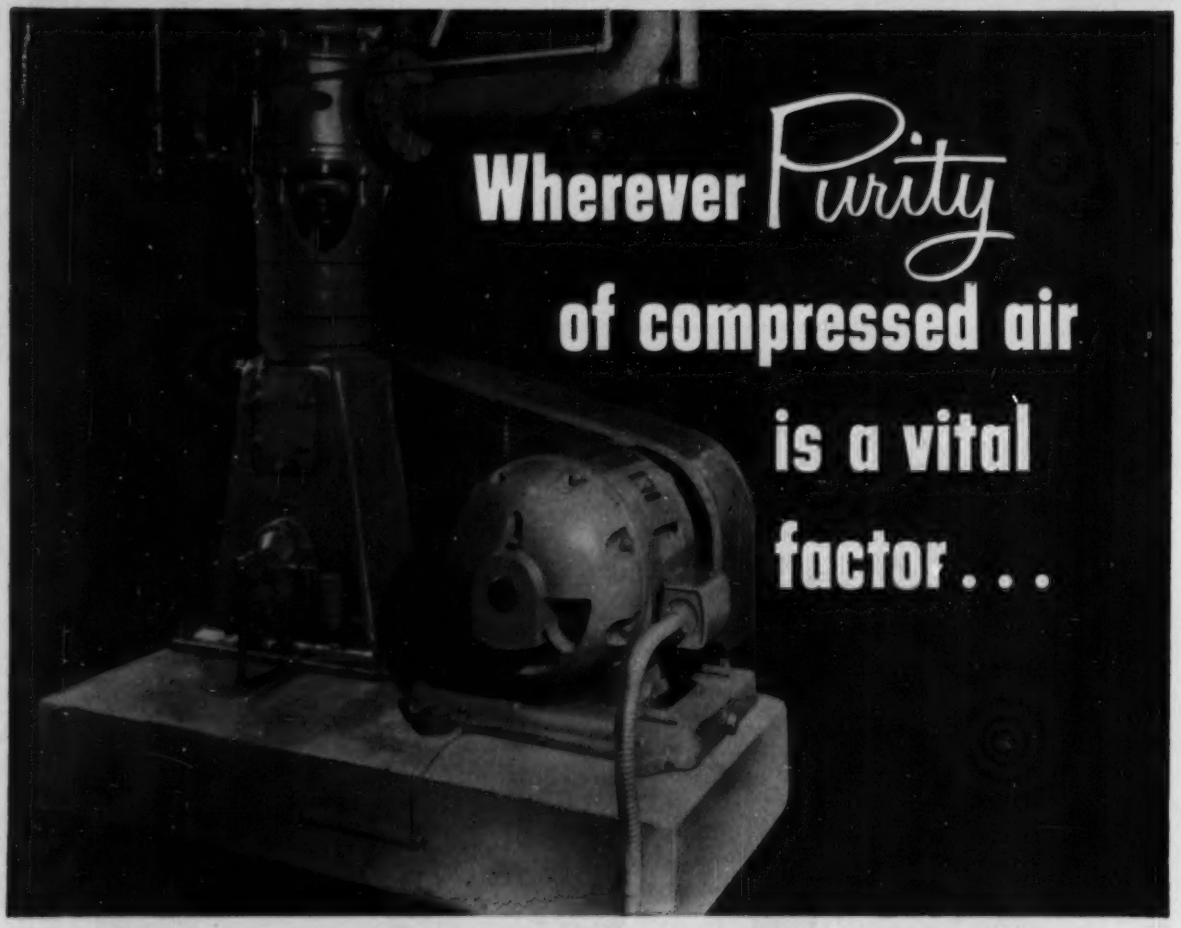

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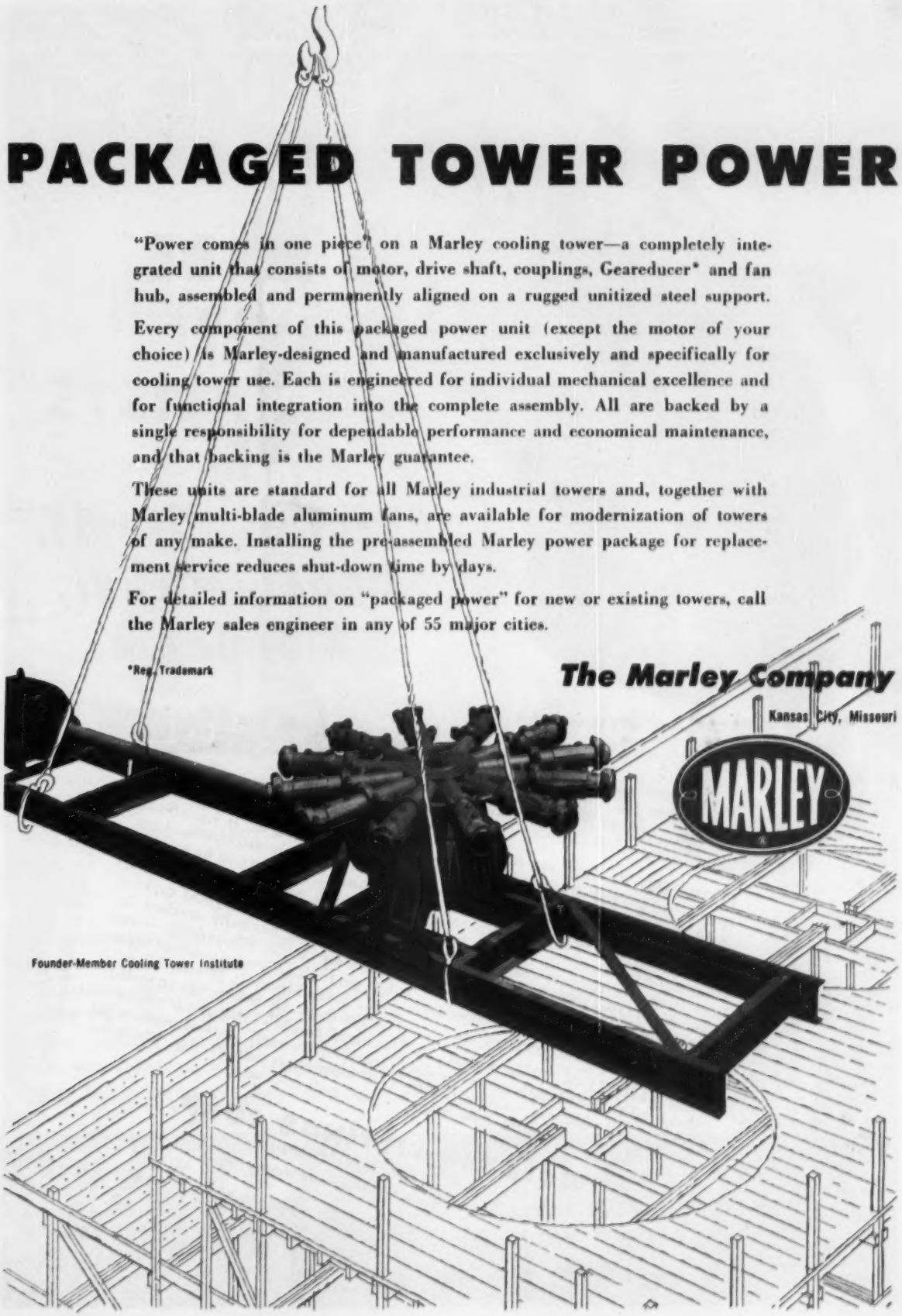

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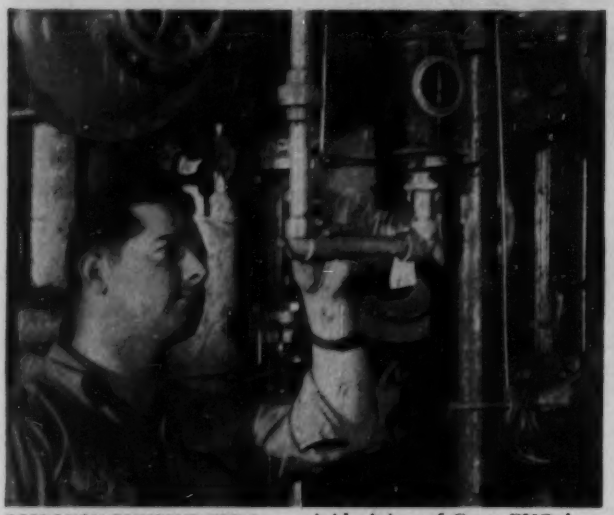

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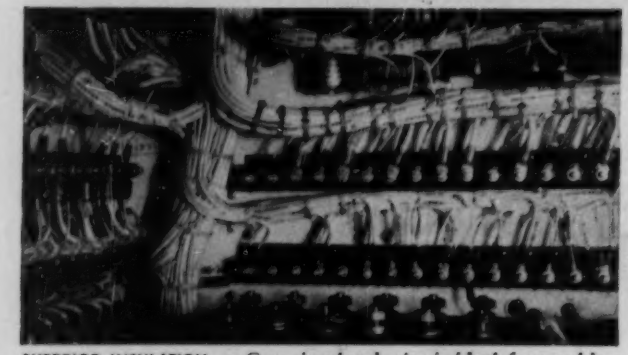

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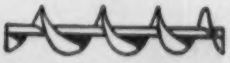

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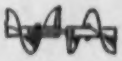

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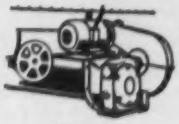

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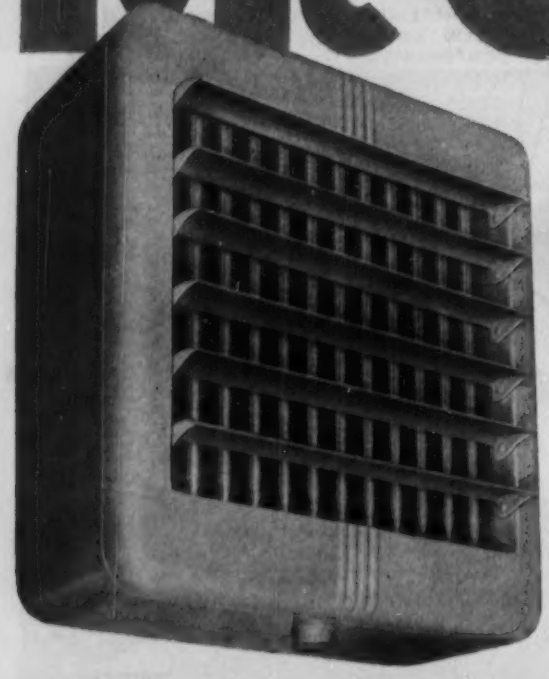

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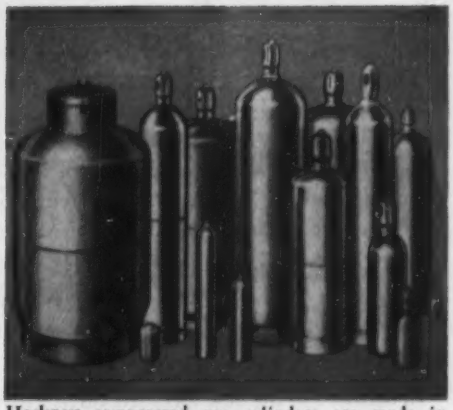

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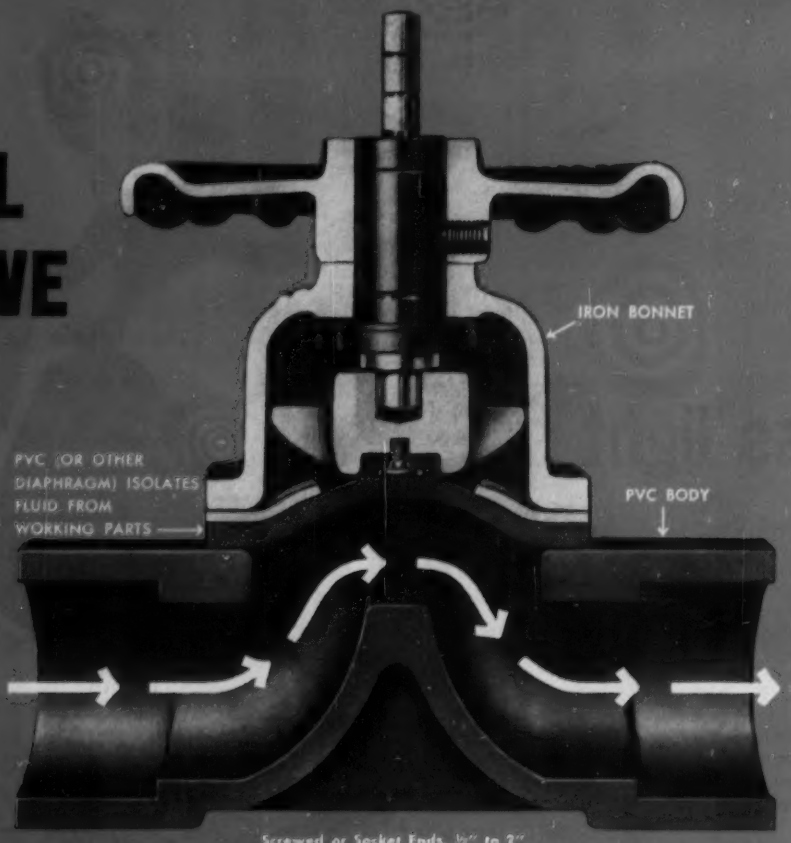
NOW a GRINNELL PVC VALVE to complete your PVC piping system



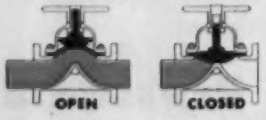
The Grinnell-Saunders PVC Valve makes it practical to have a *complete* piping system — pipe, valves, and fittings — with no other material but PVC (polyvinyl chloride) coming in contact with the fluid in the line. The body of the new Grinnell-Saunders Diaphragm Valve is made of rugged PVC; diaphragm is of PVC (or a wide range of other materials, including Teflon, Kel-F, Neoprene, Hycar and others); the bonnet is of cast-iron or malleable iron for strength and economy.

PVC, of course, has exceptional chemical resistance to aging or deterioration of any kind, and can be successfully used with most chemicals. It has high strength, light weight, and can be easily joined by threading or by solvent welding.

In addition to the new Grinnell valve with PVC body and diaphragm, Grinnell offers PVC pipe in schedules 40, 80, 120; and Grinnell PVC Fittings (screwed or socket ends). Write for further information.

Important features of the Grinnell-Saunders Diaphragm Valve:

- Diaphragm absolutely isolates working parts from fluid in the line.
- Diaphragm lifts high for full, streamline flow in either direction.
- Diaphragm effects positive, leak-tight closure.
- Diaphragm easily replaced without removing valve body from the line.



GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

SPARKLER
horizontal plate
FILTERS

Undisputed First Choice

with engineers who have had occasion to thoroughly test this type of filter. Shown here are structural features that are the result of over 30 years experience in building this one filter. If it could be made better or cheaper Sparkler would have made it that way long ago.

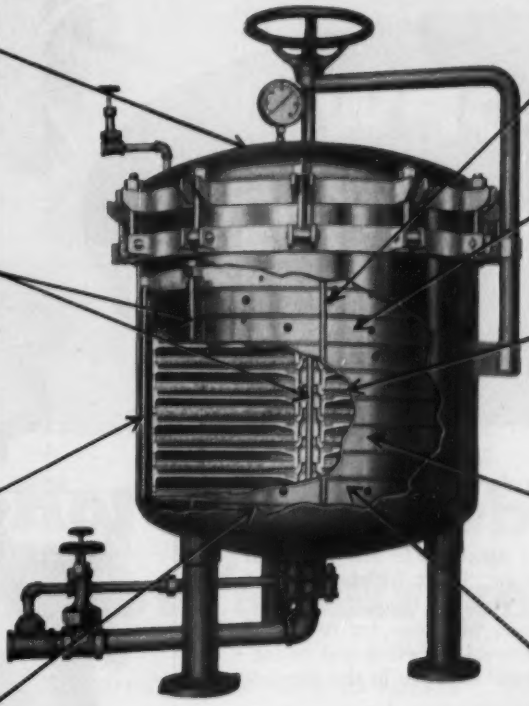
Aloysius C. Kracklauer
Originator of the Horizontal Plate Filter

A.S.M.E. designed construction is standard for pressures up to 60 lbs. on all filter tanks.

Plates sealed independently at center and periphery to assure positive seal.

Plates sealed independent of tank closure to secure a positive seal for both filter plates and for tank cover.

Scavenger plate supported by re-inforced flat bottom tank.



Cartridge plate assembly—removable indepently of tank.

Heavy solid plate rings precision machined.

Heavy perforated sheet metal support for filter paper.

A more positive filter seal is obtained when hydraulic pressure is applied to plates externally rather than internally.

Plate designed to reduce flow friction to a minimum.

SPARKLER FILTERS

The Sparkler, original exclusive horizontal plate design and flow principle, has never been equalled for efficiency and dependability in filtering with any and all types of filter aids. The cake maintains its original position as formed regardless of pressure fluctuation flow rate or viscosity. No break-through is possible, even with a complete shut down of the filter. Filtering can be resumed with perfect safety at any time. With Sparkler plate construction a completely sanitary filter can be furnished.

SPARKLER MANUFACTURING CO. MUNDELEIN, ILLINOIS

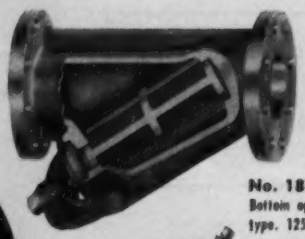
Sparkler International Ltd.—Manufacturing plants in Canada, Holland, Italy and Australia.

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

A Contamination-Free Product

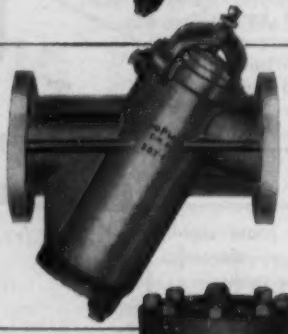
No. 187
Bottom Outlet Type

WITH OPW
line strainers



No. 187-F
Bottom opening type. 125 pound.

No. 387
Top outlet type. 125 pound.



No. 387-F
Top outlet type flanged. 125 pound.

No. 487-F
Top outlet type flanged. 200 pound.

Is your product clean enough, your pump, meter and loading valve protected against scale, grit, dirt, rust and other foreign materials?
Be sure! Install OPW Line Strainers in any pipe line system for a cleaner product. Tight fit of cage and screen assures all product passing through strainer. Screen areas are many times pipe size for full flow. The simplicity of screen removal, cleaning and replacing facilitates regular, periodic checkup in the shortest possible time.
Choose your size, type and mesh! 125-pound standard or 200-pound high pressure types. Bottom or top outlet cage, reinforced for sturdiness and precision fit. Screwed or flanged end. Flanges, bolts and gaskets to suit. Strainer meshes from 14 to 300.

JORDAN CORPORATION
INDUSTRIAL SALES DIVISION OF OPW CORPORATION
6013 WIEHE ROAD — CINCINNATI 13, OHIO
ELmhurst 1-1352

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

Hot acid scrubs tomorrow's refrigerator

A typical example of B. F. Goodrich improvement in rubber

THAT sheet of steel will soon be a refrigerator—*gleaming white* because of the steaming hot acid bath.

To clean rust off steel so enamel will stick, miles of sheets are run through tanks of hot acid that eats off the film of rust. B. F. Goodrich made this low-cost method practical by developing a rubber and brick tank lining that stands the hot acid and the slicing, banging of fast-moving steel.

The sheets used to move over stationary skid blocks but these soon wore out with rubbing plus heat plus acid. Now B. F. Goodrich makes a series of small rubber rolls that really turn and the one remaining reason for frequent shutdown has been cured. What's more, the new B. F. Goodrich segment rolls cost one-third less than the old-fashioned type, yet last 3 times longer.

B. F. Goodrich specializes in rubber equipment to handle acids and other corrosive chemicals. Today you'll find B. F. Goodrich rubber covered rolls and rubber lined tanks, pipes and valves in the most modern plants. More important, you'll find rubber lining in some places where it has lasted 15 and even 20 years.

When you buy B. F. Goodrich lining you buy years of engineering background with it—experience that makes sure your lining will be exactly fitted to meet all the special requirements of your work. *B. F. Goodrich Industrial Products Company, Dept. M-762, Akron 18, Ohio.*

B.F.Goodrich

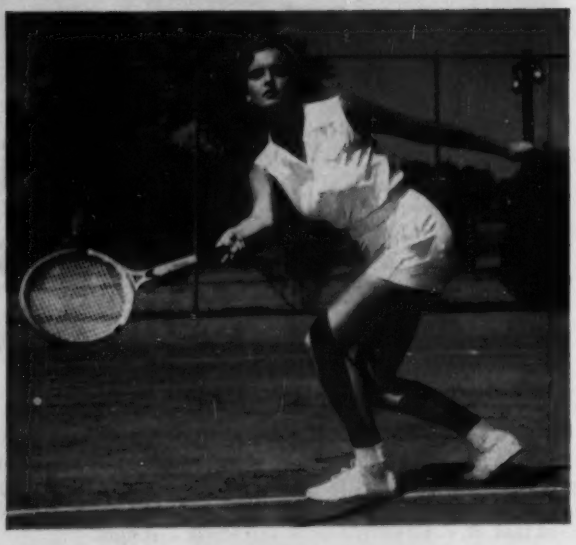
INDUSTRIAL PRODUCTS

Life

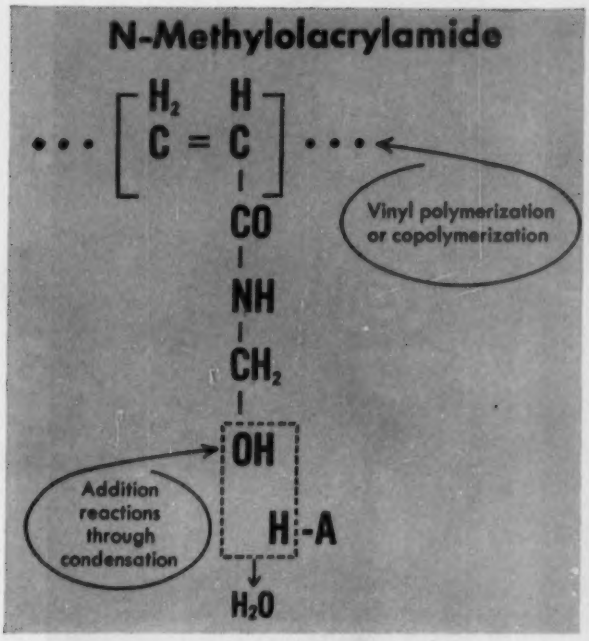
on the Chemical Newsfront

NEW HIGH-STYLED COLORPHONES show the unlimited color range and unsurpassed hardness that account for the expanding use of CYMEL® melamine molding compounds in consumer and industrial products. Color is built in for lifelong beauty, in any shade, any tone you can imagine, from sparkling white through the spectrum to deep black. Since color is molded in, there are no extra finishing steps and no coating to drip, stain or wear off. Not only telephones, but fine dinnerware, appliance housings and other molded products benefit from the excellent resistance of CYMEL to heat, abrasion, staining and household chemicals. Many types of CYMEL molding compounds are available to meet various molding and application requirements. (Plastics and Resins Division)

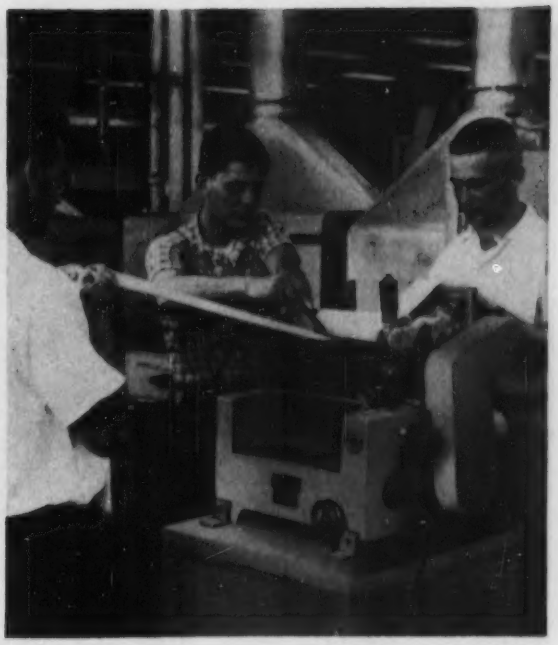
IT LOOKS LIKE A TOUGH SERIES for uniforms as for players. Hard wear, soiling, perspiration and frequent laundering take a lot out of the crisp flannels that start the season—but this year things look better. Eight major league clubs specified Cyanamid's LANASET® Finish for their uniforms because they found that the built-in shrinkage control and abrasion resistance keep them looking and fitting better. In all types of woolens, LANASET Resin penetrates the wool fibers, preserves their original finish and set, and makes shrinkage negligible. (Organic Chemicals Division)



FOOTWEAR THAT LASTS LONGER and does not discolor is one result of the use of Antioxidant 2246®. This product is well known for its ability to protect natural rubber compounds against surface deterioration, loss of flexibility and discoloration. Now its use as a stabilizer in "non-staining" synthetic rubber polymers adds a new phase to its versatility. Improved storage stability, little or no gel build-up, freedom from discoloration and protection against oxidation of the cured product are all built into these new polymers stabilized with Antioxidant 2246. (Organic Chemicals Division)



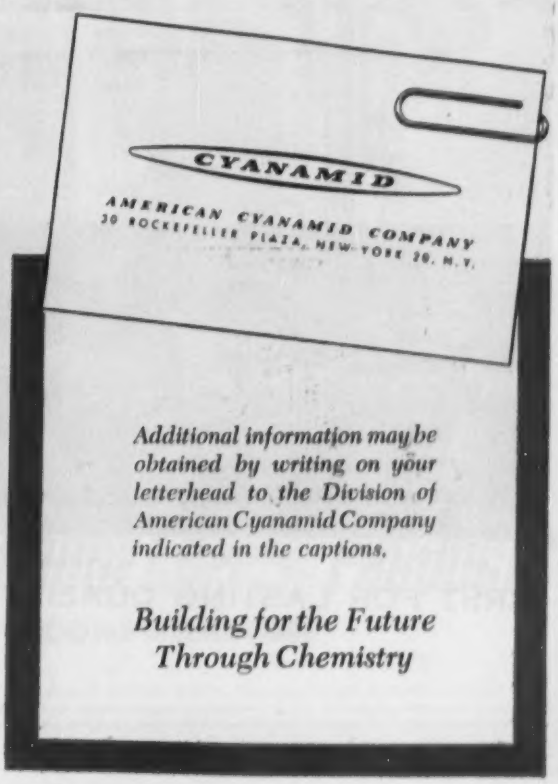
NEW BI-FUNCTIONAL MONOMER is N-methylolacrylamide, offering both addition and condensation polymerization possibilities through the active vinyl and methylol groups. The water solubility of the polymerized monomer may be modified to a desired degree through the incorporation of suitable hydrophobic monomers. Such resins show promise for sizing, dye additives and similar applications. Chain polymers or copolymers may be subsequently cross-linked through condensation, suggesting applications in adhesives, cements and thermosetting plastics. N-methylolacrylamide is available in research quantities. **(New Product Development Department, Dept. B)**

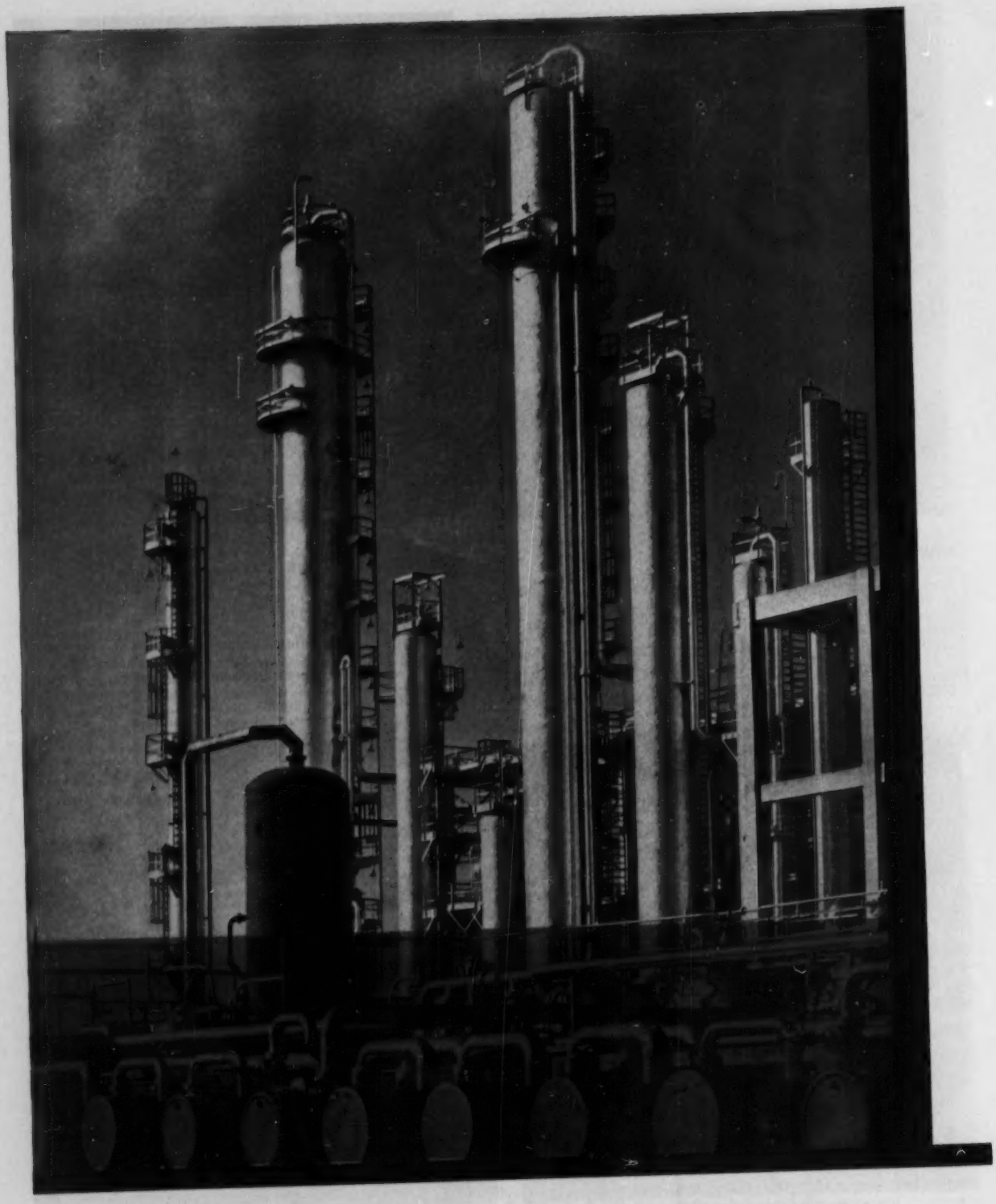


CONTROLLED PARTICLE SIZE is the criterion for the series of new improved CALCOLOID® Vat Dyes developed by Cyanamid. Above, a speck test is one of many performed to insure the high quality of these Vat Dyes now being shipped to the textile industry. Application characteristics dependent on controlled particle size, such as reduction rates, penetration and dispersion, are now more predictable, leading to better dyeing and more consistent results with continuous and batch production. Based on many years' research into dye technology, new manufacturing methods assure optimum particle characteristics for each dye for best performance. **(Organic Chemicals Division)**

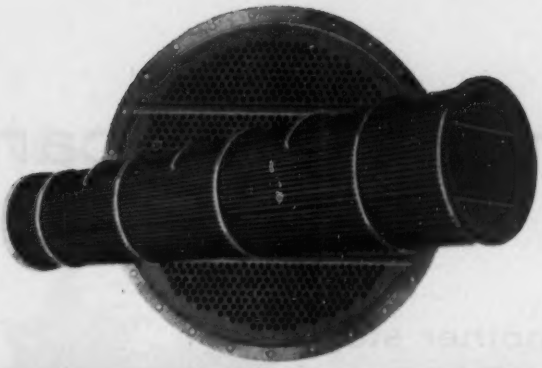
®Trademark

GROWING POPULARITY OF VINYL RAINWEAR and other vinyl products has increased demand for plasticizers based on phthalic anhydride. These and other important uses in polyester resins and intermediates for dyes, pigments and fine chemicals put domestic consumption today at 350,000,000-pound annual level. As quantity use grows, large-volume users are finding convenience and economy by switching to molten AERO® Phthalic Anhydride. Labor is reduced in handling, storing and charging into process equipment. Loss of material is minimized. Fire hazard is reduced by storage under inert gas. Plant housekeeping is greatly simplified. Cyanamid, one of the world's largest producers of phthalic anhydride, ships it in molten form throughout the country. **(Industrial Chemicals Division, Department B)**


CYANAMID
AMERICAN CYANAMID COMPANY
30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.
Additional information may be obtained by writing on your letterhead to the Division of American Cyanamid Company indicated in the captions.
Building for the Future Through Chemistry



FIRST FOR LASTING QUALITY—FROM MINE TO MARKET!



For dependable "on-stream" performance . . .
retube your exchangers with

PHELPS DODGE HEAT EXCHANGER TUBES!

Wide selection of copper-base alloys for every type of application—including bi-metal combinations.

Complete warehouse stocks maintained at Houston, Texas; Tulsa, Okla.; Los Angeles, Cal.; Chicago, Ill.; and Bayway, N. J.

Expert assistance in solving your tube corrosion problems.

Specify Phelps Dodge . . . One of the largest suppliers of tubes to manufacturers of heat exchangers!

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis-Seattle, Washington, D. C.

TOMORROW:

A standard motor that can

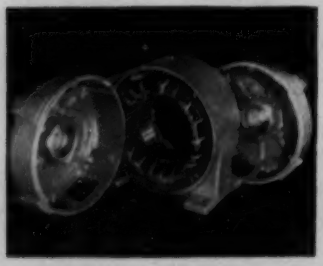
The new Life-Line A is another step closer

One of the principal causes of motor failure today is overloading. Right now Westinghouse is working on motor designs that will someday result in a motor that can survive any overload.

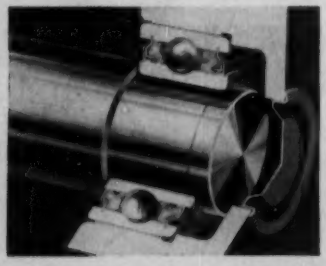
This picture shows a 15-hp Life-Line "A" motor pulling a quarter of a million pounds of locomotive on New York Central tracks near Buffalo. It's simply a dramatic way of showing the progress Westinghouse has made toward better overload protection. Improved insulation, frame construction and bearing design give the Life-Line "A" better protection against overloads than ever before. It's industry's closest approach to a standard motor that can withstand any overload condition.

Your Westinghouse sales engineer is ready to tell you about many other reasons why the Westinghouse Life-Line "A" is industry's most advanced and preferred motor. Call him today.

J-21925



New exclusive Rondite* impregnating varnish, partner to new Bondar* and Mylar† insulations, guarantees complete resistance to the heating effects of heavy overloads as well as motor contaminations.

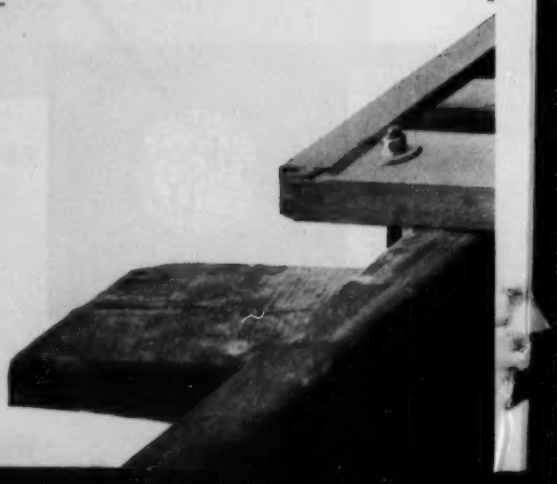


Exclusive Life-Line "A" prelubricated bearing features a new 4-way seal and completely excludes the three main causes of bearing failure: (1) contamination, (2) overgreasing, (3) wrong grease.

*Trade-Mark †Du Pont Registered Trade-Mark

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING **TODAY!***



stand any overload?
9117
Motor and Control -
standard ratings now
available for immediate delivery
from warehouses coast-to-coast!

to consult

CHEMICO

for engineering and construction of chemical and petrochemical plants

Utilizing...

owners' processes to develop flow diagrams, plant layouts, specifications and equipment designs to engineer and construct complete projects on a turnkey basis

or . . .

the plans and specifications of other engineering firms

or . . .

the designs and processes developed by Chemico for the manufacture of basic heavy chemicals and petrochemicals.

•

Consult Chemico on any project in the development, diversification or expansion of your business.

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A SUBSIDIARY OF ELECTRIC BOND AND SHARE COMPANY

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525 West 43rd Street, New York 36, New York

World-wide experience . . . technical ingenuity . . . complete facilities . . . record of achievement . . . are your assurances that a CHEMICO plant is a profitable investment.

Chemico has world-wide experience. In the course of its 42 years of service to industry, Chemico has built many types of chemical and petrochemical plants, incorporating the latest technical advances in plant design. Among its accomplishments are the expeditious completion and the successful operation of over 1000 important projects in the United States, Canada, Mexico, Brazil, England, France, Italy, Egypt, India, Japan, Philippines, and South Africa.

Chemico has technical ingenuity. It maintains continuous interest in the development of new processes and the improvement of existing techniques for the production of synthetic ammonia, methanol, formaldehyde, nitric acid, urea, sulfuric acid, acetylene and allied products.

Chemico has complete facilities. It handles every detail of a project from preliminary planning and economic surveys, through engineering and design—purchasing, inspection, shipment of material and equipment—to erection and start-up operation.

It maintains a modern, fully equipped research laboratory and pilot plant, where its own and clients' processes are thoroughly tested.

Chemico has a record of achievement.

In **synthetic ammonia,** Chemico-designed plants provide approximately 25% of the world's total production.

In **sulfuric acid,** Chemico-designed contact plants yearly produce over 30% of the world's total production.

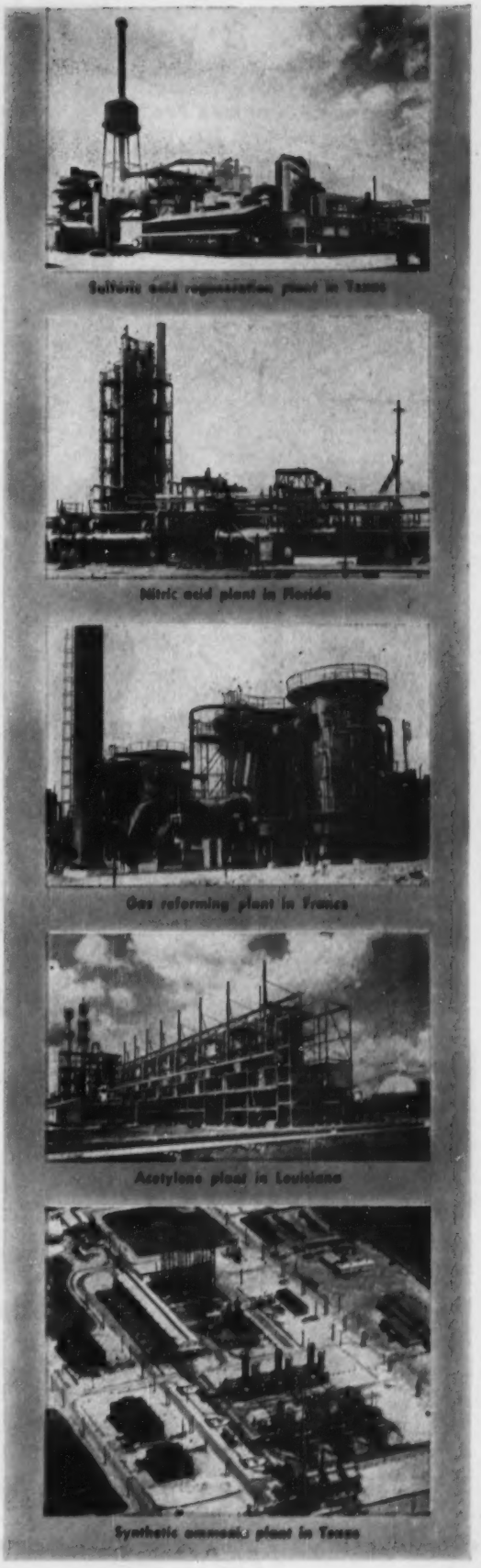
In **nitric acid,** Chemico-designed plants are operating with full power recovery.

In **ammonium nitrate,** Chemico-designed plants are producing over 1,500,000 tons per year.

In **ammonium sulfate,** Chemico-designed plants are producing over 2,500,000 tons per year.

In **acetylene,** Chemico-designed plants in operation and under construction will have a total capacity of over 150,000,000 pounds per year.

CORPORATION



Sulfuric acid regeneration plant in Texas

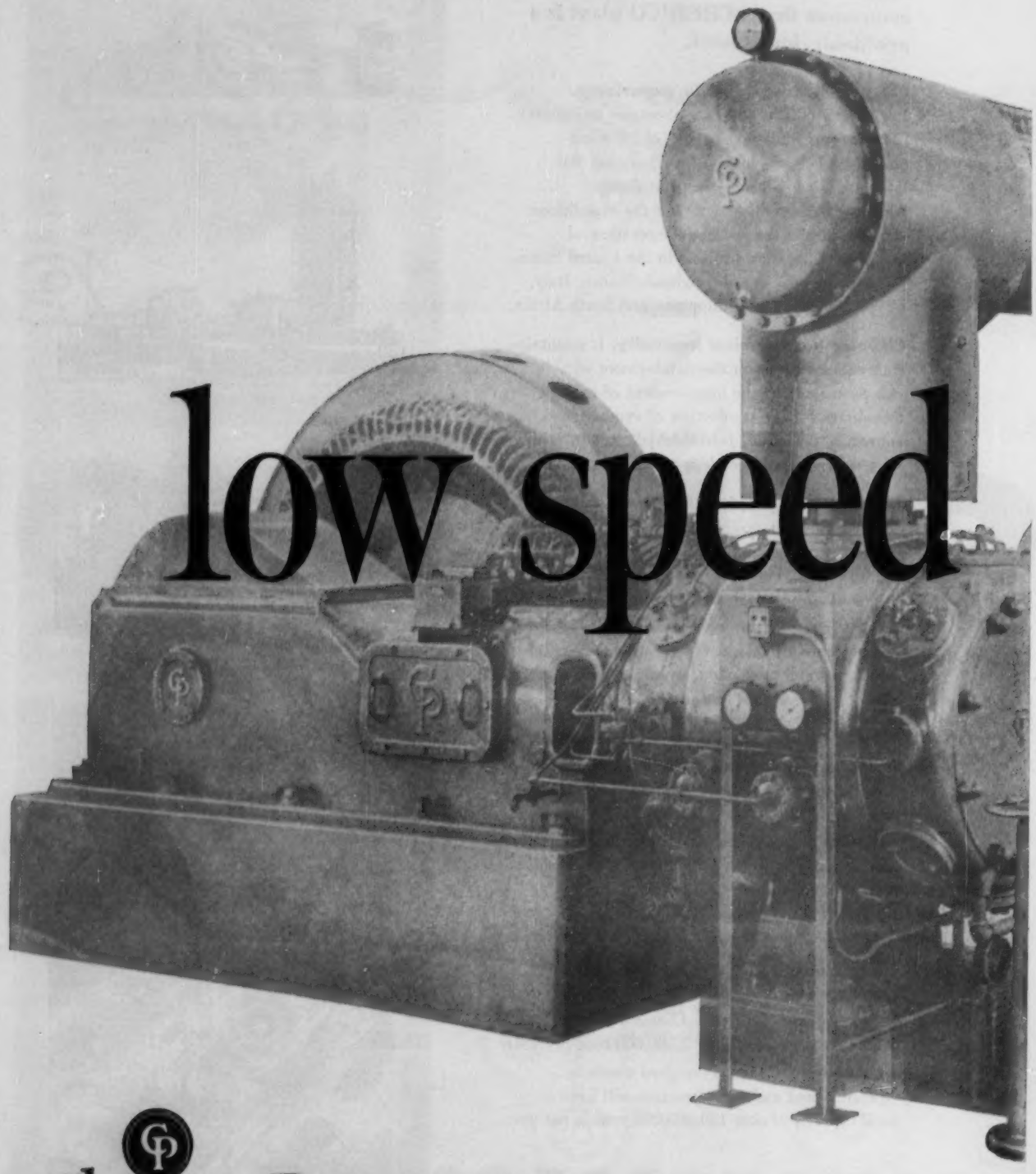
Nitric acid plant in Florida

Gas reforming plant in France

Acetylene plant in Louisiana

Synthetic ammonia plant in Texas

ONE OF A SERIES FEATURING VARIOUS TYPES OF CHICAGO PNEUMATIC COMPRESSORS



low speed

Chicago Pneumatic 8 East 44th Street, New York 17, N. Y.

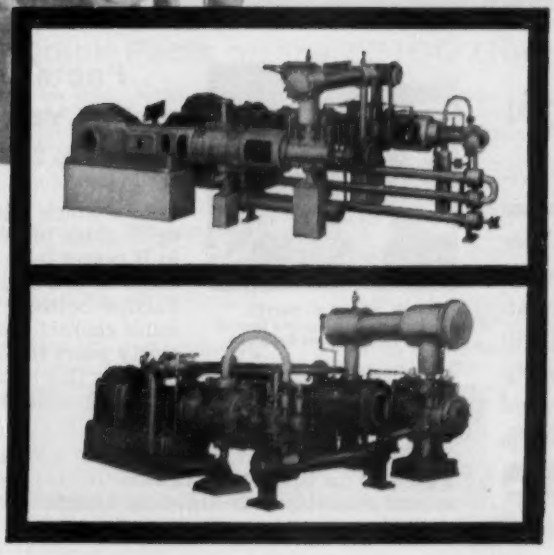
AIR AND GAS COMPRESSORS • VACUUM PUMPS • PNEUMATIC TOOLS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS

Class O compressors

for maximum availability

- **FOR PRESSURES TO 15,000 PSIG**
- **SIZES 200 TO 1000 HP**

(other CP Compressor models available in sizes up to 5000 hp)



Class OCE-5 five-stage, horizontal duplex ethylene gas compressor.

Four-stage Class OCE-4, slow-speed compressor handling hydrogen at 3000 psig.

Now Another
Balanced Vision in

Now . . . American Optical is proud to announce an outstanding development in vision and safety . . . CLEAR AND CALOBAR CORRECTIVE CURVE SUPER ARMORPLATE TILLYER LENSES.

• • •

AO ULTRASCOPIC Safety Glasses with BALANCED VISION are the Ultimate in Eye Protection

There are over 420 combinations in the American Optical line of metal (F5100 series) and plastic (F9500 series) safety glasses. You can give every worker the type of eye protection he needs. You can fit any worker.

SEE THESE SAFETY GLASSES WITH BALANCED VISION AT THE AO BOOTH, NATIONAL SAFETY SHOW.

The Big Benefit is BALANCED VISION

With "compensated" or balanced vision throughout the lens, the worker obtains optimum seeing qualities from his glasses whether he looks up, down, laterally or straight ahead. Naturally, this "balanced vision" will increase visual efficiency and safety on the job . . . reduce production and eye accident costs. This advance is available in all regular prescription ranges.

DR. EDGAR D. TILLYER, internationally recognized Dean of Ophthalmic Lens Design.

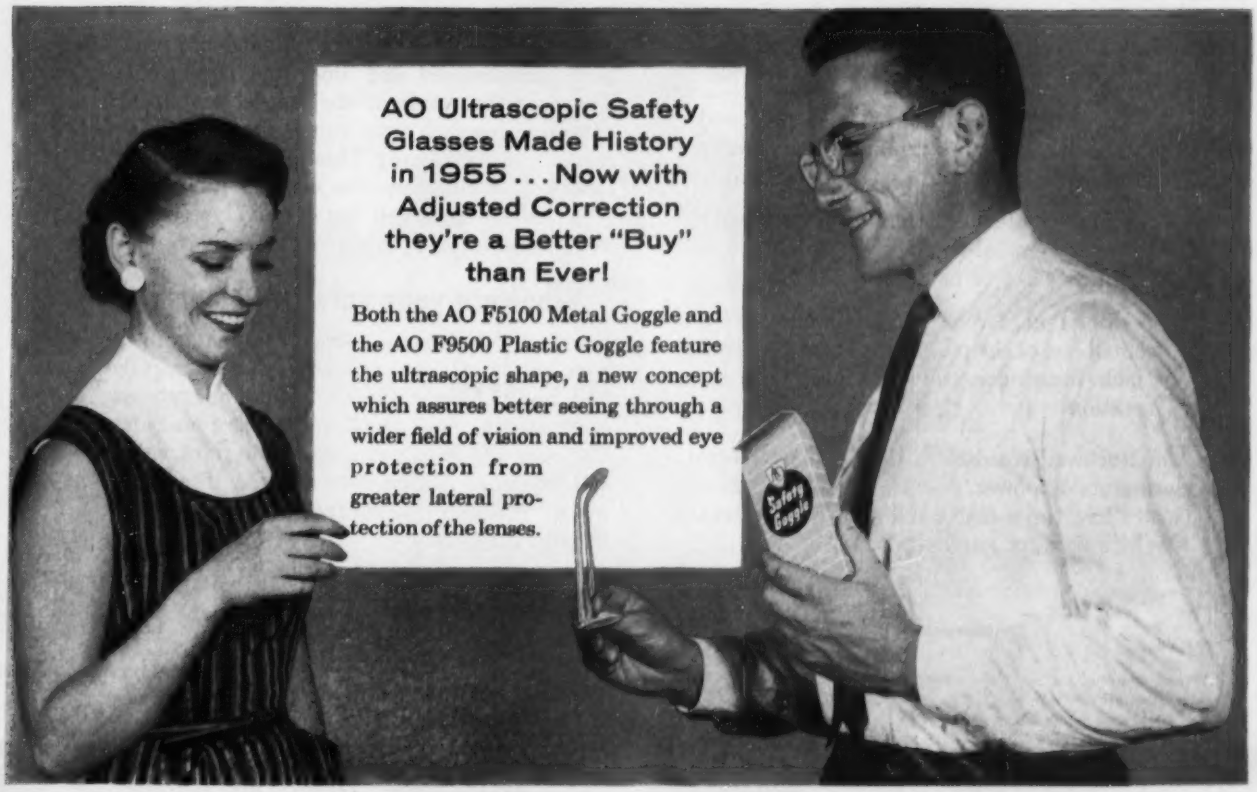
Facts about the AO TILLYER Principle of ADJUSTED CORRECTION

Lenses which interpret the services of the ophthalmic profession should be constant in R power from center to edge. Such constant R power depends upon achieving a balance between marginal sphere and cylinder characteristics of the lens. For over thirty years the Tillyer Principle has been the accepted standard in achieving this balance. Now, new computations make it possible to apply the well-known Tillyer Principle to safety-thickness S.A.P. lenses.

Electronic computing gives a new scientific dimension to lens perfection. This advance for the first time is adapted to safety lenses and is now available with American Optical eye protection equipment.

AO—"First"!

Safety Rx Glasses


AO Ultrascopic Safety Glasses Made History in 1955 . . . Now with Adjusted Correction they're a Better "Buy" than Ever!
Both the AO F5100 Metal Goggle and the AO F9500 Plastic Goggle feature the ultrascopic shape, a new concept which assures better seeing through a wider field of vision and improved eye protection from greater lateral protection of the lenses.
Safety Goggle

Quick Facts on the F5100 Goggle

EYEWIRE — Designed to hold lenses safely without strain. Lenses if struck will be retained more effectively against being forced out of frame.

TEMPLES — Cable and spatula types (the latter available only on goggles without side shields). Both types easily adjustable and very comfortable.

BRIDGE — Increased thickness for extra long life, permanently trued, permanently adjusted.

SIDESHIELDS — No brace bar obstructs vision. Removable, individually fitted and adjustable, double-braced for strength. Size for each frame clearly marked.

NOSE PADS — Acetate, won't corrode, easily replaceable. Very comfortable — they spread goggle weight evenly.

LENSES — Planos are interchangeable. AO Tillyer 6 curve Super Armorplate Clear or Calobar (medium, dark or extra dark) . . . with Balanced Vision.

NICKEL CONTENT — Maximum to prevent corrosion yet maintain flexibility.

ENDPIECES — Reversible on side shield model for compact folding.

PAD ARMS — Wide solder area for durability, no sharp bends, long guard arm for greater range of adjustment.

SCREWS — Deeply grooved for easy replacement of components. Wide shoulders mean long life at a vulnerable spot.

BEADED ENGRAVING — Women workers like a touch of distinction like this — an American Optical exclusive.

Always insist on the AO trademark on lenses and frames.

American Optical
SAFETY PRODUCTS DIVISION

Note! AO's F9500 Series Plastic Safety Glasses provide similar advances in engineered eye protection. Features include cup goggle type security and fitting in a spectacle, side shield goggle . . . dielectric qualities . . . safety standard flame resistant plastic frames, and other advantages.

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

Why Rockwell-Nordstrom Cost Less to Use in ANY

Corrosion control, longer life:

In Rockwell-Nordstrom valves, *the seat is never exposed to corrosive or erosive line materials.* And at all times the plug is surrounded by a tough film of pressurized lubricant to provide:

—a protective coating between plug and body that prevents grinding wear, means longer valve life and easier operation.

—a far tighter seal than is possible with ordinary metal-to-metal closure. Holds lightest gases or heaviest fluids.

—lubricant, forced into a chamber at the small end of the plug, serves as a hydraulic jack, insuring continuous, dependable operation.

And Rockwell-Nordstrom simple quarter turn closure makes power, gear, or wrench operation two to five times faster than ordinary valves. Ideally suited for automation.

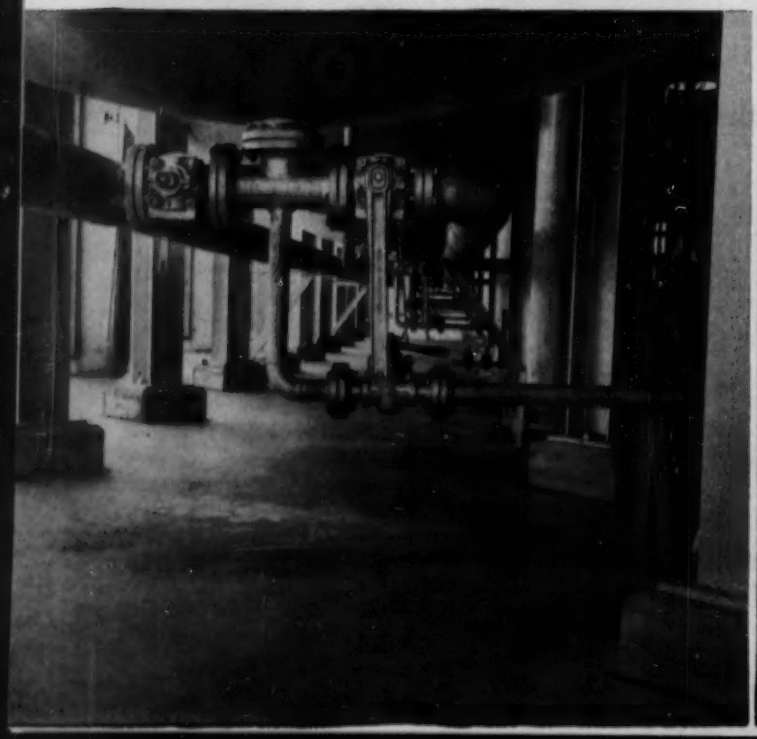
Genuine Rockwell-Nordstrom lubricants:

There are genuine Rockwell-Nordstom lubricants to meet almost any combination of pressure, temperature and line fluid conditions. They are the result of the longest and most extensive research into valve lubricants ever made by any company. Their purpose is to help Rockwell-Nordstrom—the *original* lubricated plug valve—give you the best valve service you have ever had, *at the lowest yearly cost.*

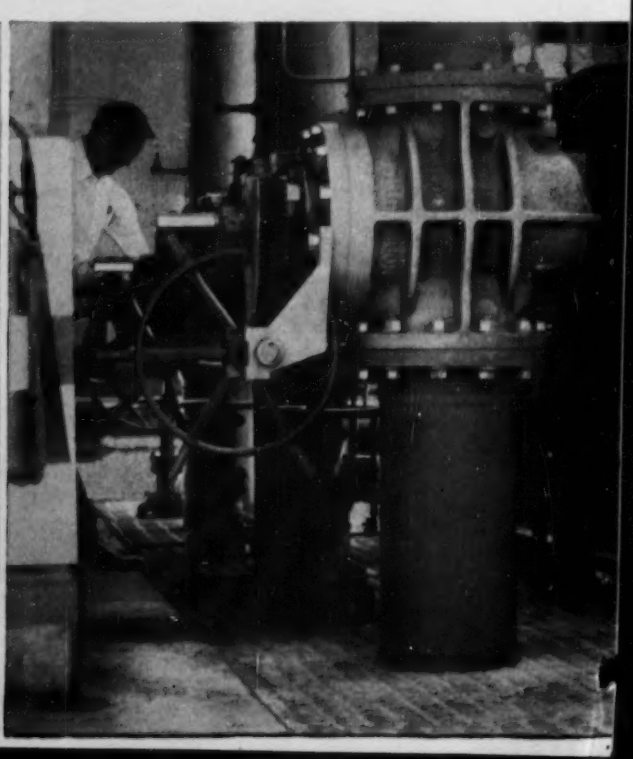
What are your valve problems?

Rockwell-Nordstrom valves are made in a wide range of sizes, pressures, special metals and body designs for chemical and process applications. Your Rockwell-Nordstrom Sales Engineer can help you specify the right valve and lubricant combination for your needs. Or write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Wrench operated Rockwell-Nordstroms on these latex tank blowdown lines provide leak proof control under constant operation that would soon ruin ordinary valves.

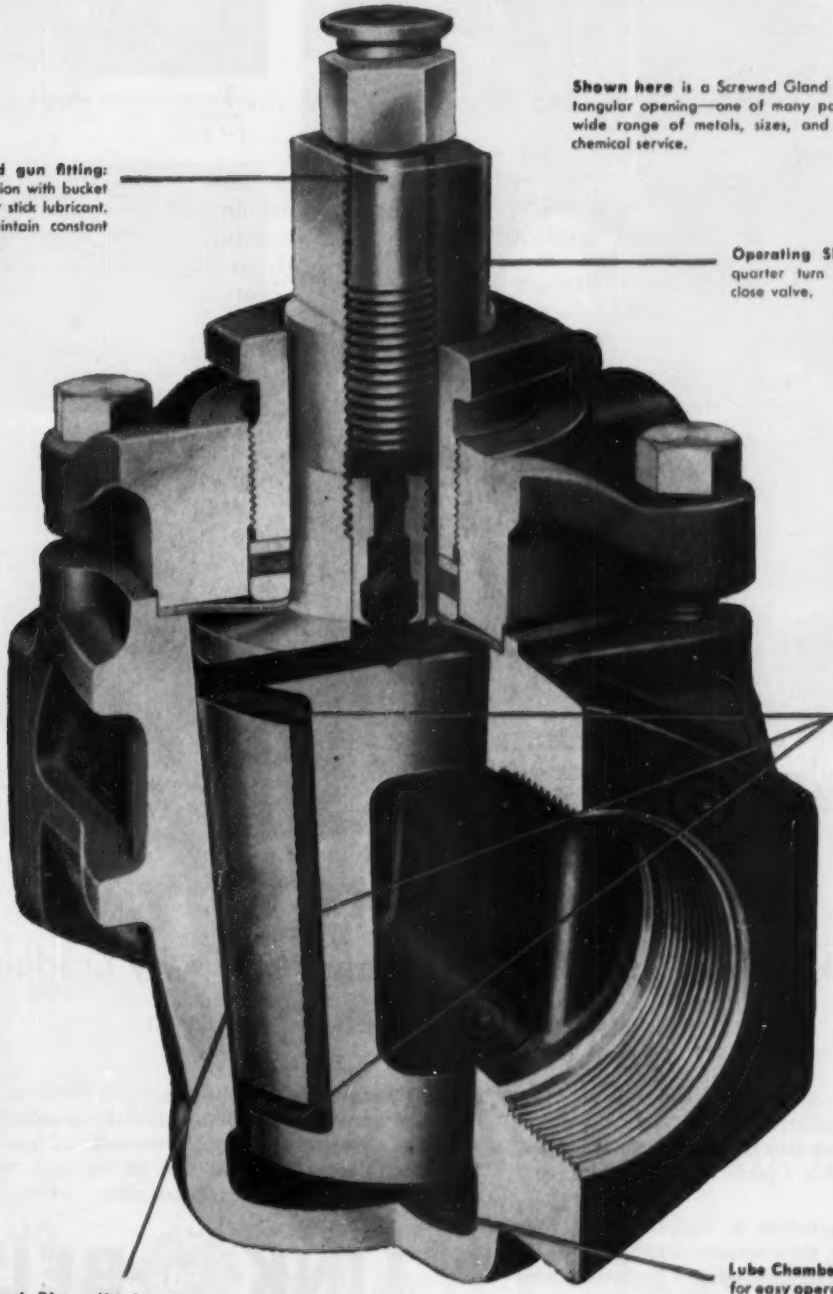


These Rockwell-Nordstrom gear operated valves assure fast, dependable control on dry hydrogen supply lines at a big ammonia plant.



Lubricated Valves

Chemical Process Service



Shown here is a Screwed Gland steel valve with rectangular opening—one of many patterns available in a wide range of metals, sizes, and pressure ratings for chemical service.

Lube Screw and gun fitting: Easy, fast lubrication with bucket gun, hand gun, or stick lubricant. Check valves maintain constant lubricant pressure.

Operating Shank: Quick quarter turn to open or close valve.

Lube Channels: "Sealdport" lubricant system assures perfect seal. Lubricant eliminates metal-to-metal friction.

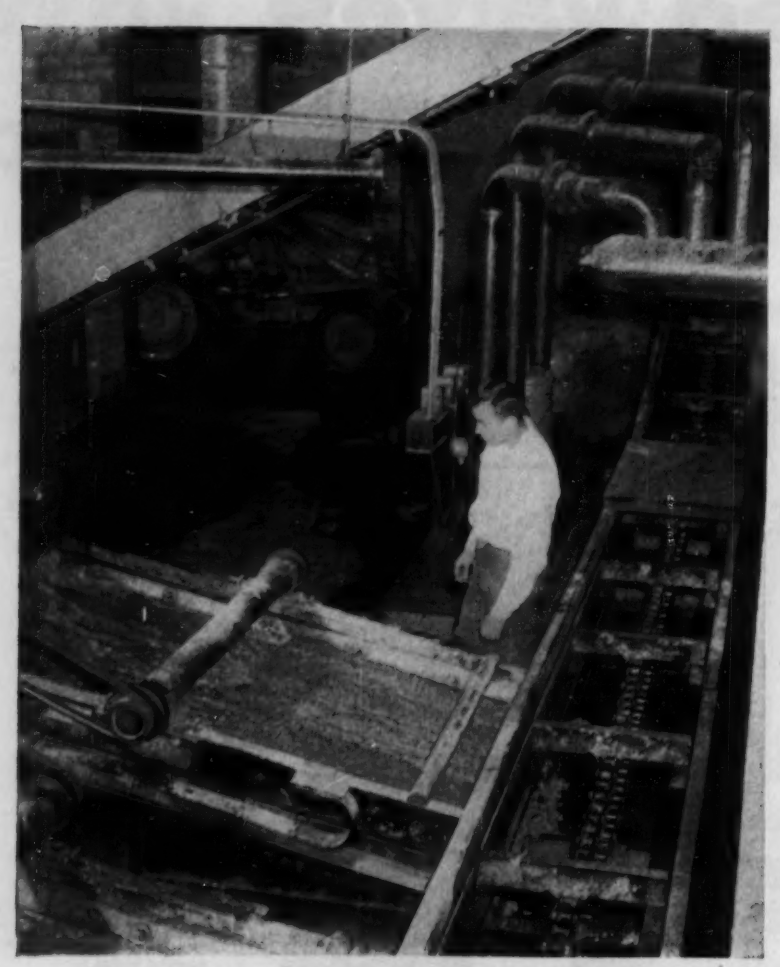
Tapered Plug: Maximum strength, positive seating, perfect sealing.

Lube Chamber: Jack plug for easy operation, if necessary. No stuck or galled valve down-time.

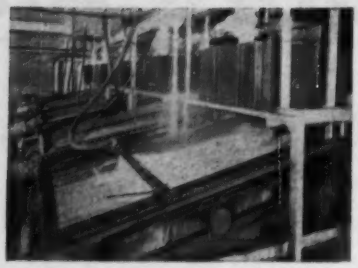
ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

40th YEAR *of lubricated plug valve leadership*

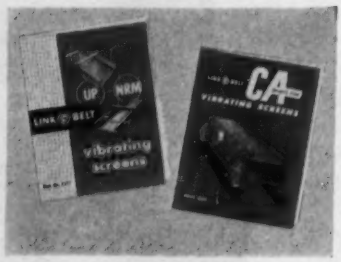


CHEMICAL WASTES can be profitable. These Link-Belt Liquid Vibrating Screens, combined with a Thru-Clean Bar Screen, Straightline Grit Collector and flight conveyor, remove solid wastes for later sale as feed and fertilizer.



Five liquid screens are used to reclaim dewatered pulp and clarified water for re-use.

High-energy vibrators keep meshes open, assure low-cost removal of solids from waste water.



Books 2377 and 2554 describe the complete line of Link-Belt vibrating screens for chemical plants.

Waste pays its way

when Link-Belt Liquid Vibrating Screens reclaim by-products and help put a halt to stream pollution

EVERY day, thousands of dollars literally go down the drain in industrial "waste." In many cases, an analysis by a Link-Belt engineer might show how it could be salvaged at a profit with Link-Belt Liquid Vibrating Screens.

Working on a principle of high-frequency, low-amplitude vibration, these screens can be adjusted for most effective separation. Solids are retained, liquids are passed—stream pollution is reduced.

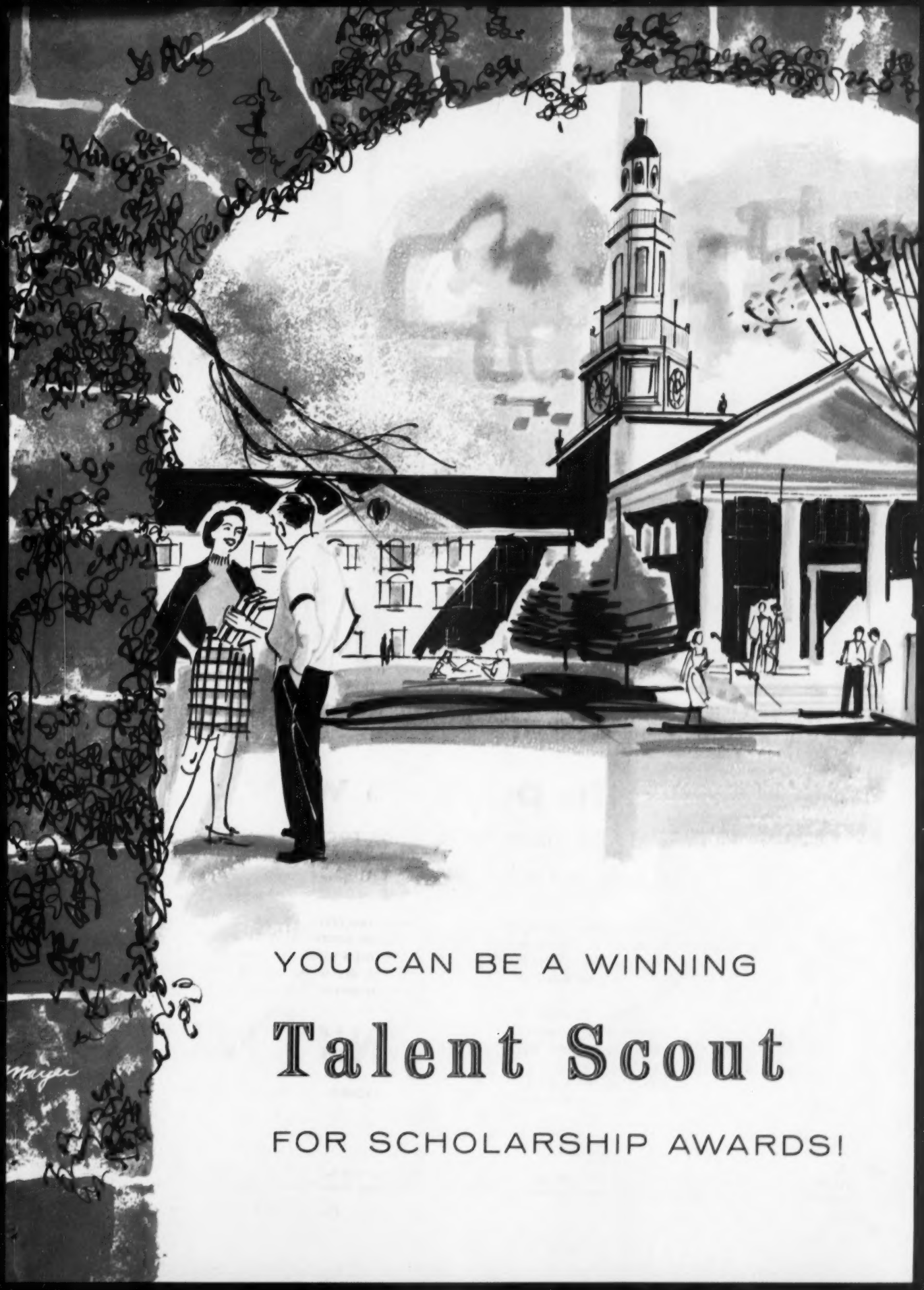
Whatever your screening problem, there is a Link-Belt vibrating screen to do the job. Smooth, powerful vibrating action prevents plugging or blinding, assures fast, accurate separation. Adjustable amplitude permits screening a variety of materials . . . from sticky ores to soft, dry feeds. For all the facts, write or contact your nearest Link-Belt office.

LINK-BELT

LIQUID VIBRATING SCREENS

14.14z

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.



YOU CAN BE A WINNING

Talent Scout

FOR SCHOLARSHIP AWARDS!

Victor's Talent Scout Contest

VICTOR CHEMICAL WORKS
GENERAL OFFICES
155 NORTH WACKER DRIVE
CHICAGO 6

CABLE ADDRESS VICTACID - CHICAGO

OFFICE OF THE PRESIDENT

You can help guide a student's future.

We believe many of our friends would welcome the opportunity to help a deserving young person and at the same time help our country maintain its position of leadership in engineering and scientific development.

We recognize that the cost of a college education prevents some of the nation's talented high school graduates from pursuing their chosen fields in the sciences. This is a great loss to the nation and endangers our security.

Undoubtedly, many of you would like to be helpful and make it possible for some deserving young person to be selected for a four-year scholarship in science or engineering. Perhaps you know of several right now!

Victor is happy to make a modest contribution to help relieve this critical condition, and we are confident you will enjoy participating in this unusual opportunity to nominate someone of your choice.

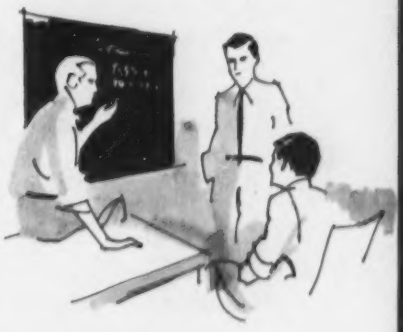
Yours very truly,

Rothe Weigel

VICTOR CHEMICAL WORKS
Rothe Weigel
President

RW/ep

Four, $4,000.00, 4-Year Science or Engineering Scholarship Awards!



You can nominate a high school graduate of your choice!

If yours is one of the 20 winning entries, some fortunate, deserving high school graduate can become your nominee and eligible for a $4,000.00, 4-year Victor scholarship award.

If you send in a winning entry, you may nominate any 1957 high school graduate you wish. It may be your son, daughter, a relative or friend.

It's easy to win!

Write, in a one-page letter (not over 500 words), the kind of a program you think industry should adopt to stimulate the interest of high school graduates in becoming scientists or engineers.

Within a few minutes, you can probably think of several ideas which could be adopted by industry to help solve this acute problem. Just write a page letter giving your ideas for a program. Remember, writing ability is *not* necessary to win. Originality will count most in the final judging. That's all there is to do.

The 20 winning entries will have the honor of nominating a 1957 high school graduate of their choice, according to the rules sent at the time winning entries are selected.

Here's an opportunity for you to help maintain and strengthen the great American heritage of scientific and engineering leadership—possible only if each of us, in our individual way, does something to encourage the nation's talented young people. It's a chance for *you* to be a talent scout for the scientific and engineering leaders of tomorrow!

Each of the 20 winning entries will also receive a personalized, genuine leather attaché case.

VICTOR
Dependable Name in Chemicals
for 58 Years

See next page for contest rules and official entry blank

Here's all you do . . .

Write, in a one-page letter (not over 500 words), the kind of a program you think industry should adopt to stimulate the interest of high school graduates in becoming scientists or engineers.

CONTEST RULES

1 All entries will be based upon originality and the basic ideas presented. Writing ability is *not* necessary to win. All entries should be typed and must be accompanied by a properly filled-out Official Entry Blank.

2 All residents of the continental United States are eligible to enter, except students, employees of Victor Chemical Works, their families, or members of their advertising agency.

3 Each contestant may enter the contest one time only.

4 Entries will be judged by The Reuben H. Donnelley Corporation. The decision of the judges will be final. In case of ties, duplicate prizes will be awarded. All entries and ideas presented become the property of Victor Chemical Works.

5 Contest closes midnight, November 30, 1956. All entries must be postmarked not later than that date and received not later than December 14, 1956. Entries must be mailed First Class to: Victor Talent Scout Contest, P. O. Box 5767, Chicago 77, Illinois.

6 Winners will be notified no later than March 1, 1957.

7 If you are one of the 20 winners, you will earn the right to nominate a 1957 high school graduate of your choice for a 4-year, $4,000.00 scholarship in science or engineering.

8 Of the 20 graduates nominated, 4 will be elected for 4-year scholarships.

9 The 4 winning nominees will be selected by a committee appointed by the American Chemical Society. Nominees will be eligible on the basis of rules sent at the time the winning entries are selected.

VICTOR
Dependable Name in
Chemicals
for 38 Years

Official Entry Blank

VICTOR TALENT SCOUT CONTEST

Name_____

Address_____

City_____ Zone_____ State_____

Company_____

Title_____

Attach to your entry and mail to: Victor Talent Scout Contest, P. O. Box 5767, Chicago 77, Illinois

PRINTED IN U.S.A.

Problem: Lengthen time between turnarounds...

Raise production...

Solution: Ljungstrom® Air Preheater

With a Ljungstrom stills stay on stream at top capacity months longer, because preheated air mixes more thoroughly with fuel. More complete combustion greatly reduces slag forming material. You generate higher flame temperatures, increase heat-transfer rates.

That's why four of your present processing units can do the work of five. With Ljungstrom Air Preheaters each unit's output can increase as much as 25%. Example: One pipe still in an eastern refinery went from 12,000 barrels to 18/20,000 barrels after application of a Ljungstrom.

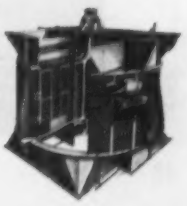
How fast is "WRITE OFF"?

Ljungstrom has many other advantages. You save up to 20% in fuel... furnace design is more economical, with no need for convection surfaces... many fuels you used to throw away can be used... through-put is consistently improved... product quality is higher. You can see, therefore, why a Ljungstrom is paid out in nine months or less.

For more complete details on what the Ljungstrom Air Preheater can do for you – for an analysis of the heat recovery benefits attainable in fuel burning equipment – call or write The Air Preheater Corporation.

Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

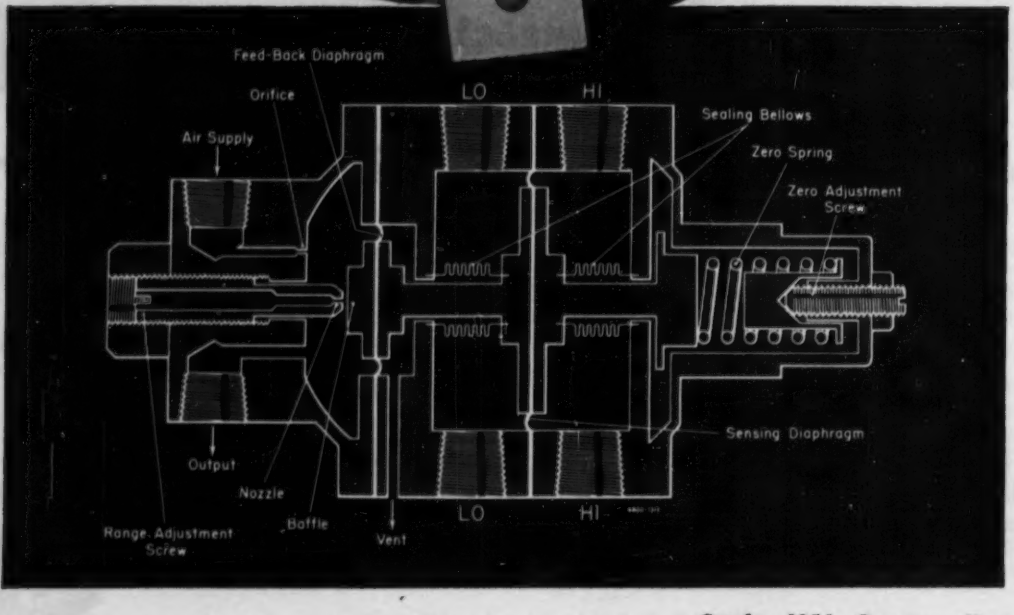


The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

Taylor Presents

ACTUAL SIZE 6½" x 3"

No. 200TD111



NEW LOW COST FLOW TRANSMITTER

The new Taylor Fixed Range Differential Pressure Transmitter (200TD111) provides an excellent, economical means of measuring flow, liquid level, or pressure. A 3 to 15 psi signal is transmitted to an indicating, recording or controlling receiver with an accuracy of 1%. Its remarkably low price makes it a practical cost accounting aid for many applications previously considered marginal. Check these features:

Simple to install. Piping is simplified because it can be close coupled to orifice flanges. Can be lead-line or bracket mounted. No seal pots required. Mercuryless, no leveling required. Force-balance construction means negligible displacement. 4½ lb. weight, 6½" x 3" size make it easy to handle.

Easy to maintain. External zero and range adjustments. Self draining or venting. Over-range to full working pressure with no permanent damage. Purges, if required, can be installed to keep body swept clean. Minimum number of parts.

Reliable accuracy. Calibration accuracy is better than 1%. Unaffected by piping or mounting stresses. No errors build up during operation because of self draining and venting feature. Pressure effect 2%/150 psi (100" range). Temperature effect 2%/100°F. (100" range). Sensitivity exceeds 0.1%.

Rugged and dependable. No stuffing box, levers or pivots. No relay valve. Compact, weatherproof, built for rough service and outdoor mounting.

Adaptable. Ranges 0 to 50, 100, 200 and 300 inches of water—easily and quickly changed by substitution of range ring and diaphragm.

No. 200TD111, Fixed Range Differential Pressure Transmitter. Immediate Delivery from Stock.

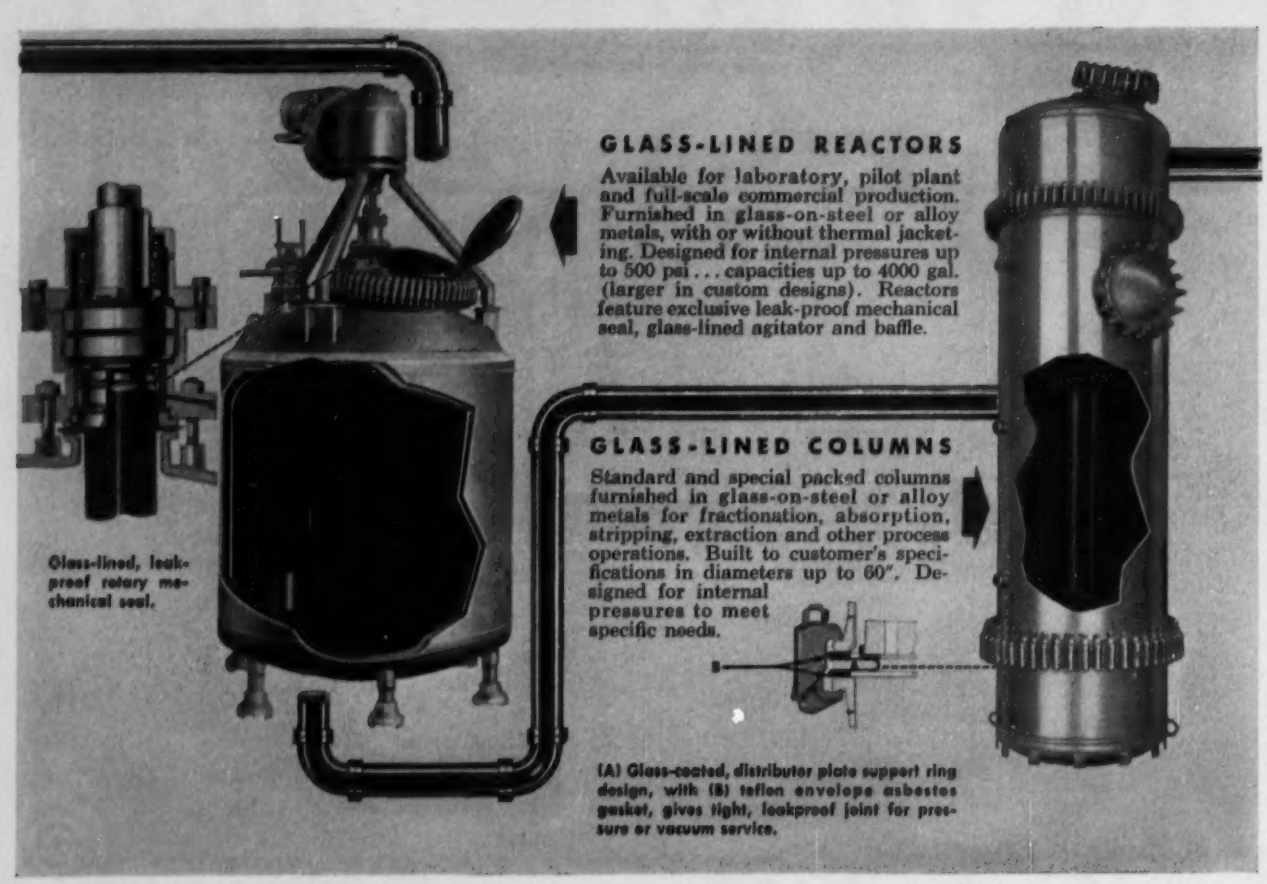
Call your Taylor Field Engineer to discuss possible applications for this remarkable new instrument in your plant. And write for **Bulletin 98274.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

DESIGN SPECIFICATIONS

Diaphragm of Neoprene impregnated Nylon.
Body material brass.
Maximum working pressure 150 psi.; temperature 150°F.
Air Supply pressure, 20 psi.
Air consumption, 0.10 standard cu. ft. per minute.
Output pressure range 3 to 15 psi.
Size 6½" x 3", Weight 4 lbs. 9 oz.
All connections ¼" internal NPT.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

Whatever your process . . . insist on Glascote glass-lined products


GLASS-LINED REACTORS
Available for laboratory, pilot plant and full-scale commercial production. Furnished in glass-on-steel or alloy metals, with or without thermal jacketing. Designed for internal pressures up to 500 psi . . . capacities up to 4000 gal. (larger in custom designs). Reactors feature exclusive leak-proof mechanical seal, glass-lined agitator and baffle.
GLASS-LINED COLUMNS
Standard and special packed columns furnished in glass-on-steel or alloy metals for fractionation, absorption, stripping, extraction and other process operations. Built to customer's specifications in diameters up to 60". Designed for internal pressures to meet specific needs.
Glass-lined, leakproof rotary mechanical seal.
(A) Glass-coated, distributor plate support ring design, with (B) teflon envelope asbestos gasket, gives tight, leakproof joint for pressure or vacuum service.

Glass-lining gives the ultimate in corrosion-resistance . . . zero contamination . . . lower cost through longer service life

YOU can use Glascote glass-lined equipment — from start to finish — for processing a variety of corrosive materials. Glascote's glass-linings put an end to contamination.

Whatever your processing system, you, too, will find it profitable to use Glascote's glass-lined equipment — pipe and fittings, reactors, columns, storage tanks, rotary dryer-blenders, etc. All designed for dependability, durability, flexibility of application and economy of operation.

What's more, you can be sure of product purity, because Glascote's chemical-resistant, acid-alkali glass offers greater resistance to corrosive action . . . greater versatility for processing products. And Glascote also offers you non-stick glass which is ideal for polymer production of all types.

Remember, for efficient heat transfer and extra-long service life insist on Glascote glass-lined products.

Ask the representative who calls on you for all the facts about Glascote products—reactors, storage tanks, columns, conical rotary dryer-blenders, receivers, condensers and accessory products. Or, if you prefer, write direct. Glascote Products, Inc., Cleveland 17, a subsidiary of A. O. Smith Corporation.

Our standard one year guarantee continues to apply to all Glascote glass-lined products.

Glascote®

PRODUCTS, INC.

CLEVELAND 17, OHIO

Sales offices or agents located in New York • Philadelphia • Union, N. J. • Chicago • Cleveland • Dayton • Houston • Los Angeles
Export Sales: A. O. Smith Corp., International Div., Milwaukee 1, Wis.

from START to FINISH

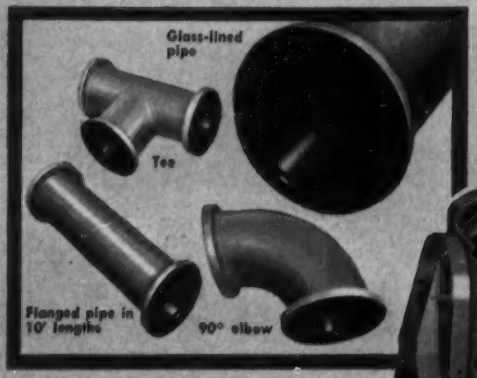
GLASS-LINED HEAT EXCHANGER TUBES

Efficient, corrosion-resistant Heat Exchangers are assembled from lengths of standard diameter jacketed pipe. Adequate heat transfer area is available for most applications using various heating and cooling media. The use of either elbows or return bends provides a versatile operating assembly.

GLASS-LINED STORAGE TANKS

Single shell glass-lined *horizontal* furnished in standard units in capacities up to 6000 gal. (larger on special order).

Vertical glass-lined units furnished in four standard structural types—plain and jacketed, open and closed. Standard tanks built in capacities up to 6000 gal. (larger on special order).



GLASS-LINED PIPE AND FITTINGS

Glascote produces and stocks glass-lined pipe in 10' lengths and fittings to ASME standards, in inside diameters from 1½" to 4". Six and 8", and larger sizes are fabricated to order. Leakproof gaskets available to suit material conveyed in pipe.

GLASS-LINED CONICAL, ROTARY DRYER-BLENDERS

Standard acid-alkali, glass-lined, conical, rotary Dryer-Blenders available in capacities — 5 and 35 cu. ft. and larger on request; operating temperatures — liner 500° F, jacket 650° F; operating pressures — tank full vacuum to 25 psi, jacket 65-75 psi (50-60 psi with tank at full vacuum).

..... A subsidiary of A.O.Smith Corporation .....

The World's largest manufacturer of glass-lined steel products

Swenson Puts Ideas

For the Processing Industry!

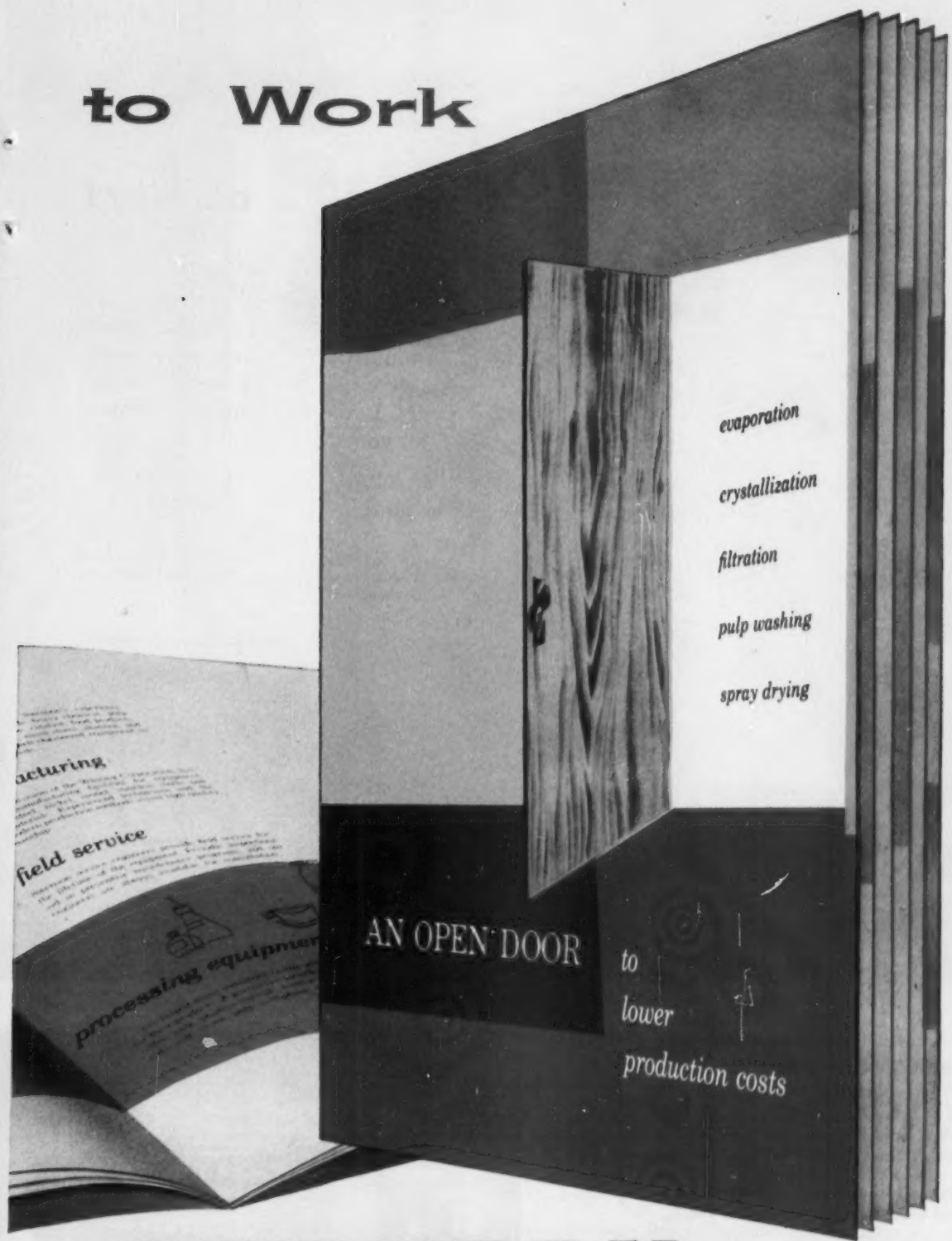
Ideas for better process methods will start to work for you when you read Swenson's new 12-page brochure, "An Open Door". Just off the press it shows how Swenson Engineering assists in solving many evaporation, crystallization, filtration, pulp washing and spray drying problems.

It introduces the facilities and operations of the Swenson Evaporator Company. Many installations of Swenson equipment are illustrated and described. Truly "An Open Door" to lower production costs, it shows how experience combined with extensive research and modern manufacturing provides the equipment best suited to particular needs. Whatever your position . . . engineer, president, manager, chemist . . . be sure to request this brochure. It is interesting and informative. Send for your copy today!

SWENSON EVAPORATOR COMPANY
15669 Lathrop Avenue, Harvey, Illinois.

Manufacturers of Evaporators, Spray Dryers, Crystallizers, Filters, Pulp Washers, Acid Resistant Heat Exchangers and other Process Equipment.

to Work

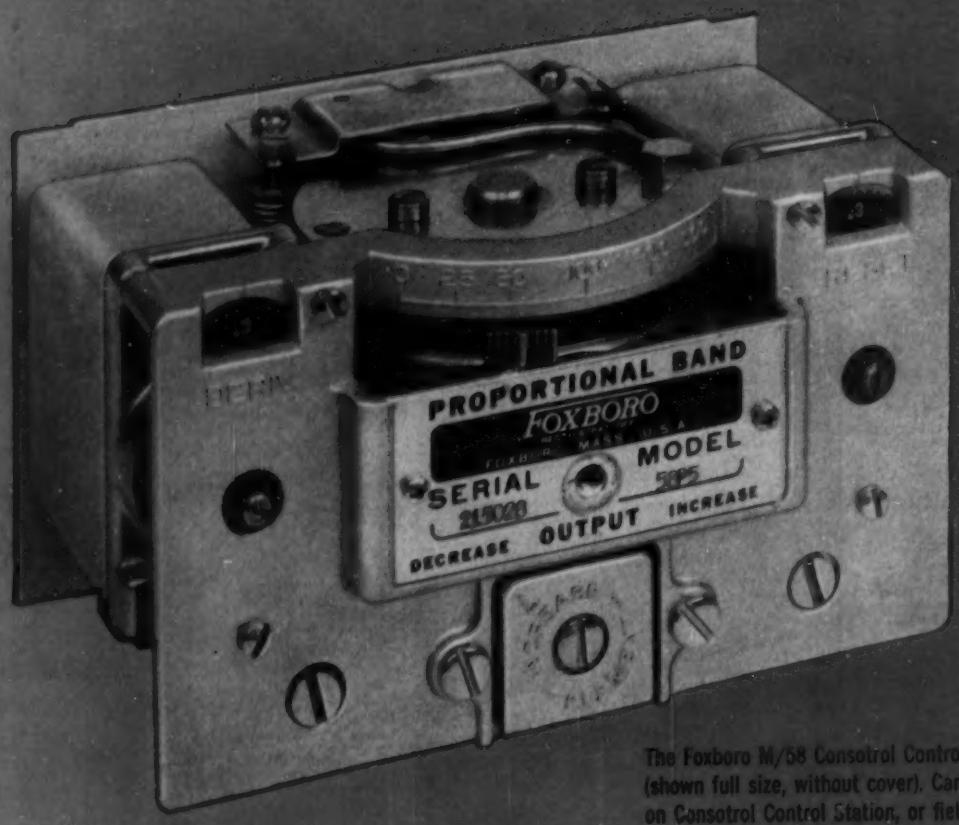


SWENSON

Proved Engineering for the Process Industries

Since 1889

A DIVISION OF
WHITING
CORPORATION



The Foxboro M/58 Consotrol Controller (shown full size, without cover). Can be panel-mounted on Consotrol Control Station, or field-mounted.

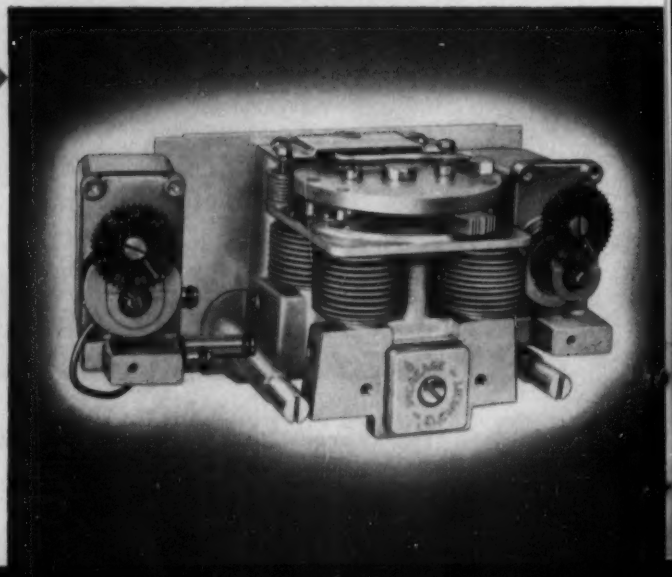
THE FOXBORO M/58 CONSOTROL

The M/58 Controller's Revolutionary Floating Disc System

Here's the exclusive Foxboro design development that gives M/58 Control its unique versatility, precision, and stability. The floating disc and matched bellows assure uniformly high controller sensitivity and pin-point control action, even at widest settings of the proportional band. Lever-set proportional band adjustment is calibrated to 500%.

Component Construction Gives Unrivaled Versatility

Not only is the complete controller easily detachable as a unit, but also, each component is a "plug-in" unit. For example, reset plugs in at right as shown; derivative, similarly, at left. All 4 control actions, with 2 reset ranges, are available and easily adjustable to widest variations in operating conditions. Proportional action from 1 to 500% quickly set by lever.



Outperforms all other controllers!

...the controller with the FLOATING DISC

If you think this claim is exaggerated, just put a Foxboro M/58 Consotrol* Controller on your process. The tougher the job, the more it will outperform other controllers! Or ask any present user . . . many of the largest, most progressive petroleum and chemical processors are using hundreds of these instruments. They will unhesitatingly confirm that this exclusive Foxboro development has put their processes "on stream", automatically and smoothly from the control room, without false starts or confusion.

The M/58 Controller can do the same for your process. The flexibility of its control functions makes it readily adaptable to *all* processing techniques. All four actions are available, with two ranges of reset . . . all are easily adjustable to the most widely varying operating conditions. For example, reset and derivative functions plug in . . . proportional action from 1 to 500% can be quickly set by a lever. And calibration is a simple zero adjustment!

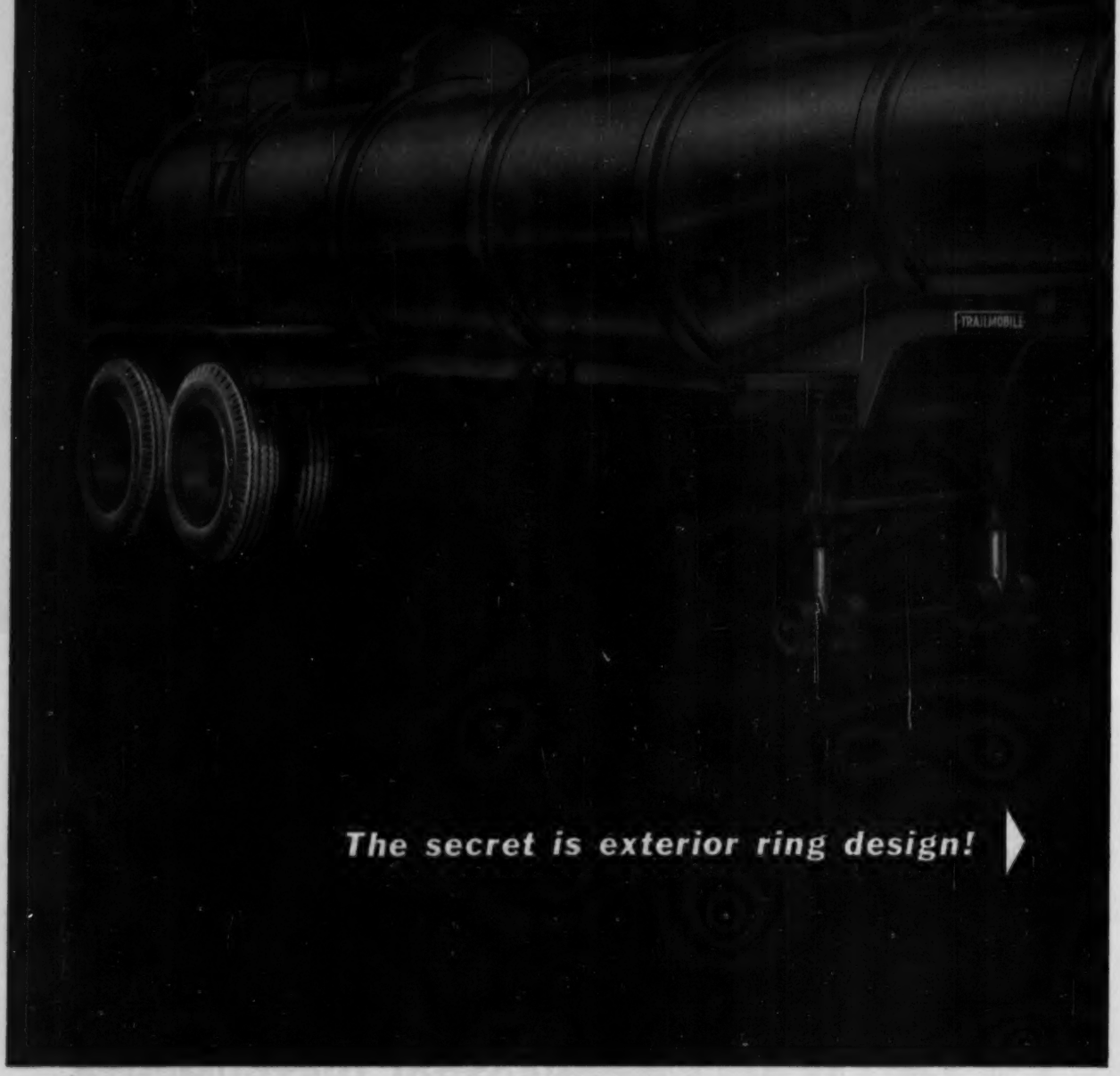
Get full details on this simple, truly "universal" Controller. Write for Bulletin 13-19 and ask your Foxboro Sales Engineer for a demonstration. **The Foxboro Company, 3610 Neponset Ave., Foxboro, Mass., U.S.A.**

*Reg. U. S. Pat. Off.

FOXBORO CONSOTROL INSTRUMENTS

Reg. U.S. Pat. Off.

New TRAILMOBILE acid



The secret is exterior ring design!

tank trailer...

has THOUSANDS of POUNDS more payload capacity

The new Trailmobile Model CH Acid Tank Trailer gives you big, extra payload capacity amounting to as much as 100 pounds for every 100 gallons of capacity built into the tank.

The secret is exterior ring design! Brawny rings of steel reinforce the new light gauge shell allowed by regulation codes. This unique design lightens the trailer by thousands of pounds while retaining structural strength.

This new Trailmobile Model CH incorporates every money-saving feature of previous Trailmobile models. It is available in high tensile steel, stainless steel or aluminum with a variety of coatings and linings to handle all types of corrosive and non-corrosive fluids. Insulated models are also available where load temperatures need to be maintained.

Check on the CH before you buy. TR-478

TRAILMOBILE INC.

Cincinnati 9, Ohio • Springfield, Missouri
Longview, Texas • Berkeley 10, California

do you want low-cost

or

LECTRO-CLAD*

Trademark

Nickel Plated Steel Plates will give it to you

Yes, you can get low-cost, yet effective protection against contamination and corrosion with all these chemicals...and many more!

Effective in heavy industrial applications where the corrosion rate does not exceed 0.0015 inches per year, CF&I LECTRO-CLAD Nickel Plated Steel Plates successfully combine the corrosion and contamination resistance of nickel and the economy and strength of carbon steel.

That's because CF&I LECTRO-CLAD is made by the Bart Process, which consists of electrodepositing a heavy layer of 99% pure nickel on a carbon steel plate. This process results in a permanent bond between the nickel and the steel base. The nickel plating is customarily supplied in the 8-10 mil range; however, it can be plated up to 15-20 mils, if specified.

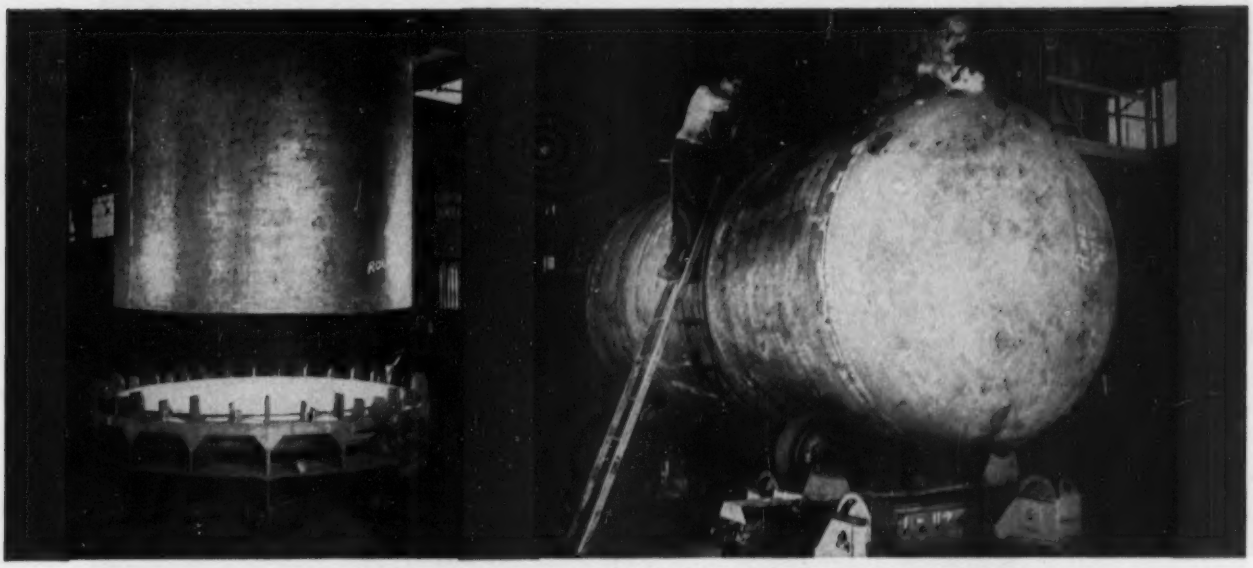
What's more, CF&I LECTRO-CLAD Nickel Plated Steel Plates are easily fabricated without costly special equipment. Just use regular shop equipment and bend it... weld it... roll it—the protective nickel layer will not check, spall or flake!

Ask our nearest sales office for the complete story on economical, effective, easy-to-fabricate CF&I LECTRO-CLAD Nickel Plated Steel Plate today. Wickwire Spencer Steel Division, The Colorado Fuel and Iron Corporation, P. O. Box 1951, Wilmington, Delaware.

*** NICKEL PLATED BY THE BART LECTRO-CLAD PROCESS**

protection against with these chemicals?

Caustic Soda • [illegible] • [illegible] • Cold Hydrofluoric Acid • Dibutyl Phthalate • Methyl Alcohol • [illegible] • [illegible] • [illegible] • Potash • Resin Plasticizers • Salt • Sodium Sulphate • [illegible] • Tetraethyl Phosphate



Assembling a tank fabricated from CF&I LECTRO-CLAD Nickel Plated Steel Plates.

3798

Claymont Steel Products

CF&I

Products of Wickwire Spencer Steel Division • The Colorado Fuel and Iron Corporation

Abilene (Tex.) • Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Casper • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston • Lincoln • Los Angeles New Orleans • New York • Oakland • Odessa • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • Seattle • Spokane • Tulsa • Wichita

CANADIAN OFFICES AT: Toronto • Vancouver

OTHER CLAYMONT PRODUCTS

Stainless-Clad Plates • Manhole Fittings and Covers • Large Diameter Welded Steel Pipe
Flame Cut Steel Plate Shapes • Flanged and Dished Heads • Carbon and Alloy Steel Plates

A
QUAKER OATS
CHEMICAL
USE
REPORT
QO
TETRAHYDROFURFURYL
ALCOHOL

important in:

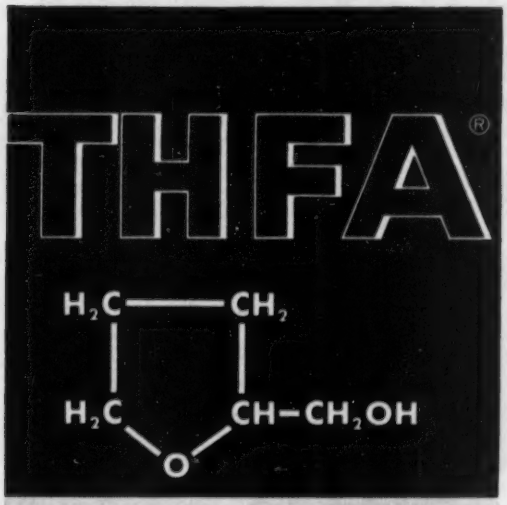


Photo: Courtesy of California Spray-Chemical Corp.

1. **Leather Finishing**

QO Tetrahydrofurfuryl alcohol is becoming increasingly important in the finishing of leather. THFA dissolves many difficultly soluble dyes and keeps them dispersed even when dye solutions cool. Its action as a highly efficient "driver" produces deep penetration and aids in leveling spray and flame coats. THFA is unusual in its ability to penetrate through the grain of leather without disturbing the fat liquor balance so necessary for flexibility and proper feel of leather. Not to be overlooked is the use of THFA as a resin solvent which aids resin penetration and adhesion to leather surfaces.

2. **Organic Synthesis:**

Tetrahydrofurfuryl alcohol acts like both an alcohol and an ether. The hydroxyl can be replaced by other functional groups, and the ring can be cleaved to a variety of open chain compounds which may be recyclized to 5- or 6-membered heterocyclic types.

THFA is used for the preparation of high boiling esters. Tetrahydrofurfuryl oleate is an example; it has found considerable use as a plasticizer.

Dihydropyran, derived from THFA, is a source of a variety of compounds including piperidine, glutaric acid and 1,5- difunctional open chain types.

3. **Esters of THFA Yield a Nonvolatile Herbicide**

Tetrahydrofurfuryl alcohol esters of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) are brush and weed killers. They have low volatility, are readily soluble in organic compounds, and contain maximum percentages of 2,4-D and 2,4,5-T components for effective herbicidal activity. These herbicides cling to brush and weeds until they're killed and control possible vapor injury to adjacent sensitive crops. They are commercially available in packaged formulations.

IMPORTANT NOTICE: Investigate new low price of THFA made possible by new process.

Write for our new Bulletin 206 on QO Tetrahydrofurfuryl Alcohol; it presents chemistry, physical properties and uses of THFA.

The Quaker Oats Company
CHEMICALS QO CHEMICALS DEPARTMENT

335L The Merchandise Mart,
Chicago 54, Illinois

ROOM 535L 120 Wall St.,
New York 5, N. Y.

Room 435L Main P. O. Box 4376,
Portland 8, Oregon

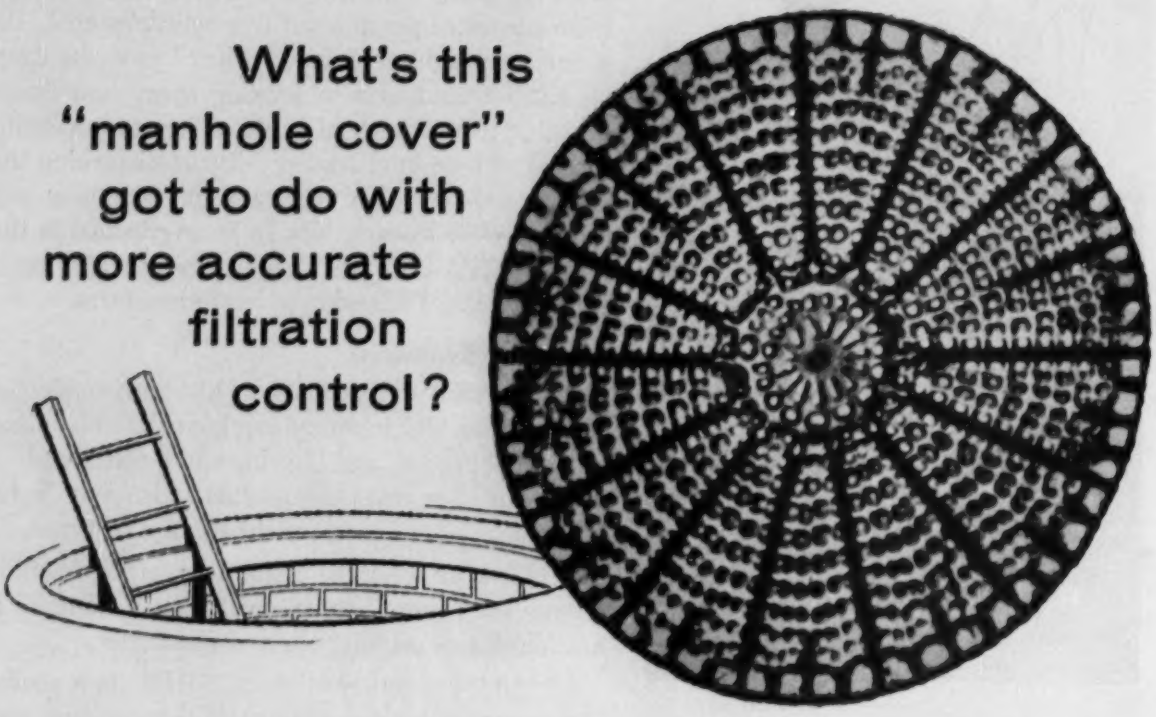
In Europe:
Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands;
Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France;
A/S "Ota", Copenhagen, S. Denmark

In Australia:
Swift & Company, Pty., Ltd., Sydney

In Japan:
F. Kanematsu & Company, Ltd., Tokyo

THIS "MANHOLE COVER" is really a magnification of *Arachnoidiscus ornatus*, one of the hundreds of different intricate particles that make Celite such an effective filter aid.

What's this "manhole cover" got to do with more accurate filtration control?



It's a particle of CELITE with the

The photomicrograph at left shows the wide variety of particle shapes and sizes in a typical Celite sample. By carefully controlling the proportions of particle sizes, the most complete range of grades is obtained.

Johns-Manville CELITE

Celite's wide range of grades permits precise control of several different filtration operations in the brewing of beer and ale. These include various ruh beer filtrations, wort filtration, final beer polishing and purification of brewing and bottle wash waters.

In industry's modern research laboratories, Celite filtration has proved itself an indispensable tool. Special grades of Celite have been developed that are particularly effective in analytical methods requiring filtration or chromotographic study.

In the manufacture of lubricating oils, Celite filter aids completely remove bleaching clay from the oil itself and also clarify the many additives used by the industry.

-the diatomite filter aid widest range of grades

Need maximum clarification? Use Celite* Filter-Cel. Or does your filtration require the fastest flow rates? Then use Celite 545. In addition, there are 7 more intermediate grades plus many special grades produced for specific applications. Thus, with Celite, you can establish the exact balance of clarity and flow rate that your process requires. No other diatomite gives you such a wide choice of grades.

Celite also gives you other important advantages over competitive filter aids. Its lower wet density provides greater surface coverage per pound. This means substantial savings because six bags of Celite actually do the work of seven bags of other diatomites.

And Celite is uniform. Every pound of Celite comes from the world's largest and purest commercially available diatomite deposit. Every pound is processed and graded at the same plant under the same conditions. Yet, with the large inventory maintained at the plant and Johns-Manville's nationwide network of warehouses, you're assured of fast, sure delivery.

So, if filtration belongs in your processing operations, it will pay you to call in your local J-M Celite engineer. Backed by Johns-Manville's research facilities and years of practical diatomite experience, he can help you with your filtration problems. Call him today or write Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

Diatomite Filter Aids

JOHNS-MANVILLE J-M PRODUCTS

Republic Stainless cuts cost of

Operator at left is removing scale accumulation from Clepco immersion heater casing made from Republic ELECTRUNITE® Stainless Steel Tubing. Any normal cleaning procedure may be followed without risk of damage to unit. And if your product demands cleanliness, the lustrous, smooth-finished surfaces of stainless tubing are clean, sanitary, and easy to keep that way. Solid stainless throughout, maintenance and replacement costs are reduced.

Operator at right is shaping 2" Republic ELECTRUNITE Stainless Steel Tubing to a bullet nose by spinning it under flame. Workability of this tubing makes it easy to fabricate. For heater casings, Cleveland Process uses both Types 304 and 316 Stainless Tubing which they find highly satisfactory for either acid or alkaline solutions—at temperatures ranging from 100° to 600°.

REPUBLIC

World's Widest Range of Standard Steels

Tubing solves breakage problem...

Clepco immersion heater casings

The Cleveland Process Company of Cleveland, Ohio, manufacturers of Clepco immersion heaters, had a twofold problem. The tube-like casings they use to house heating elements were fabricated from a brittle imported material. Scale removal was particularly hazardous—often resulting in a cracked or broken casing. Furthermore, the material itself, although an effective insulation, was expensive.

To solve these problems, Cleveland Process switched to Republic ELECTRUNITE Stainless Steel Tubing for heater casings. They found ELECTRUNITE Stainless Tubing easy to fabricate, having consistently uniform diameter, wall thickness, concentricity, strength and ductility. But most important, ELECTRUNITE completely eliminated breakage and substantially reduced material costs.

Made of long-lasting Republic ENDURO Stainless Steel, this tubing provides strong resistance to corrosion, oxidation and scaling at high temperatures. Where strength is a requirement ELECTRUNITE Stainless Tubing is ideal—providing an extremely high strength-to-weight ratio.

This tubing may be the very material you need to improve your product or process. For detailed information about the many cost-saving advantages of Republic ELECTRUNITE Stainless Steel Tubing—including sizes, gages and analyses—send coupon today for new, illustrated 60-page booklet.

REPUBLIC ENDURO® STAINLESS PIPE SAVES COSTS in paper mills. Section shown above is part of a piping system that conveys the highly corrosive pulp mixture to the processing machines. Where corrosion-resistance is vital to cost savings, the extra expense of this long-lasting piping is an inexpensive investment in long-range economy.

REPUBLIC SEMI-RIGID PLASTIC PIPE SAVES COSTS in cooling towers. Original pipe had to be replaced every four months in this cooling installation near coke ovens. A constant bath of corrosive steam saturated with hydrochloric acid soon destroyed it. Two years ago, Republic Semi-Rigid was installed with excellent results: no sign of damage to this date.

REPUBLIC DEKORON®-COATED EMT SAVES COSTS of electrical conduit in chemical plants. Wherever the atmosphere is corrosive, unprotected metal parts take a beating. But Dekoron-Coated EMT shrugs off corrosion. The tough, polyethylene coating over the galvanized finish gives double protection to electrical raceways. Send coupon for facts.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
3116 East 45th Street • Cleveland 27, Ohio

Please send me more information on:

- ☐ Republic ELECTRUNITE Stainless Steel Tubing
- ☐ Republic ENDURO Stainless Pipe
- ☐ Republic Plastic Pipe
- ☐ Republic Dekoron-Coated EMT

Name_____ Title_____

Company_____

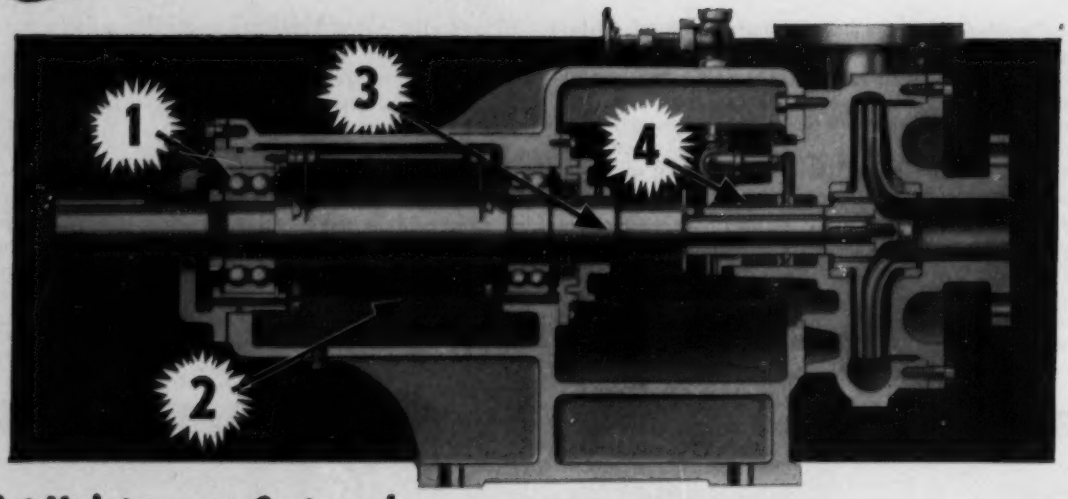
Address_____

City_____ Zone____ State_____

K-5609

ALLIS-CHALMERS
Oil-Lubricated
Chemical
PUMP

4 Check these Quality Spots



Cut Maintenance Costs and You Cut Pump Costs!

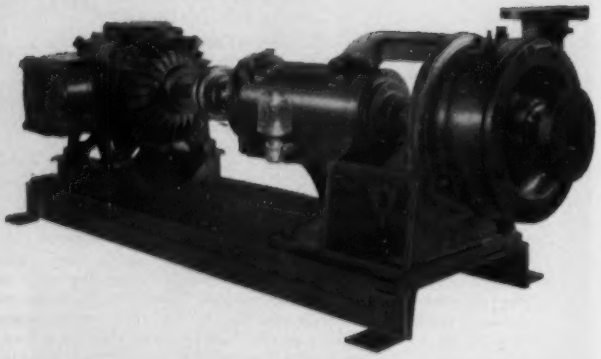
Here's an "all-around" pump designed for your industry. It costs hundreds of dollars less than refinery pumps — yet does many of the same jobs. It costs a little more than grease-lubricated pumps — yet more than makes up the difference by cutting maintenance.

It's a quality pump throughout. As shown above, it has:

1. Double-row oil-lubricated bearings with positive end closures suitable where acid or alkali vapor or abrasive dust is present.

2. Oil lubrication — which does away with the most common cause of bearing failure — overgreasing. Oil lubrication also permits operation at higher temperatures.

3. Heavy shaft — holds alignment, reduces wear of parts. Either high grade carbon steel or stainless steel is provided, depending on application. Pump can be supplied with or without shaft sleeve as desired.



4. Alternate sealing arrangements — Any one of six different sealing arrangements can be provided, including a water-cooled stuffing box where the liquid being pumped is above 250 F.

Allis-Chalmers builds many types of pumps, but this particular type is recommended for pumping liquors, corrosive materials and solutions in the most used ratings to 3500 gpm, heads to 400 feet for liquids to 550 F.

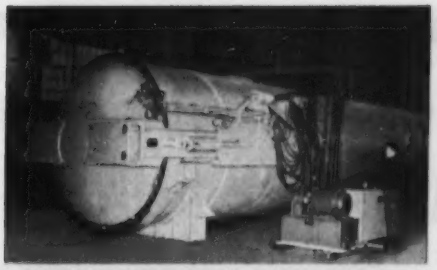
A-4870

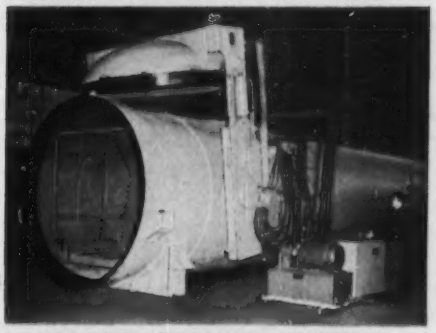
For complete information call your nearby A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin, for Bulletin 52B7638.

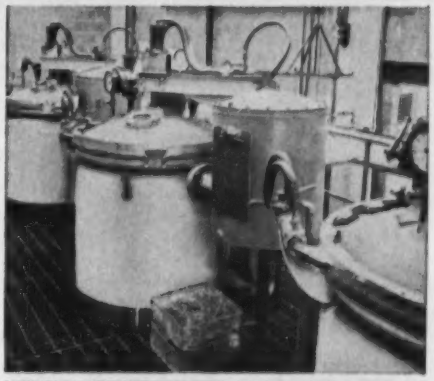
ALLIS-CHALMERS

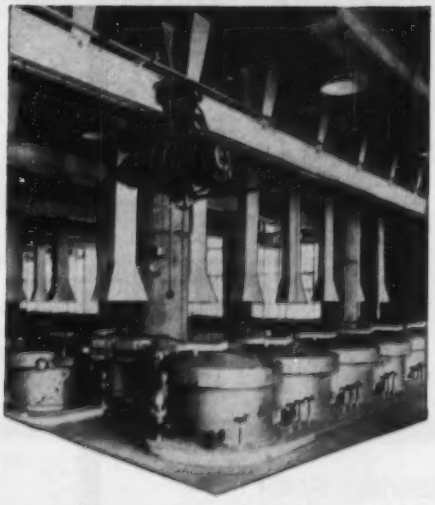
Struthers Wells

QUICK OPENING BOLTLESS DOORS PATENTED







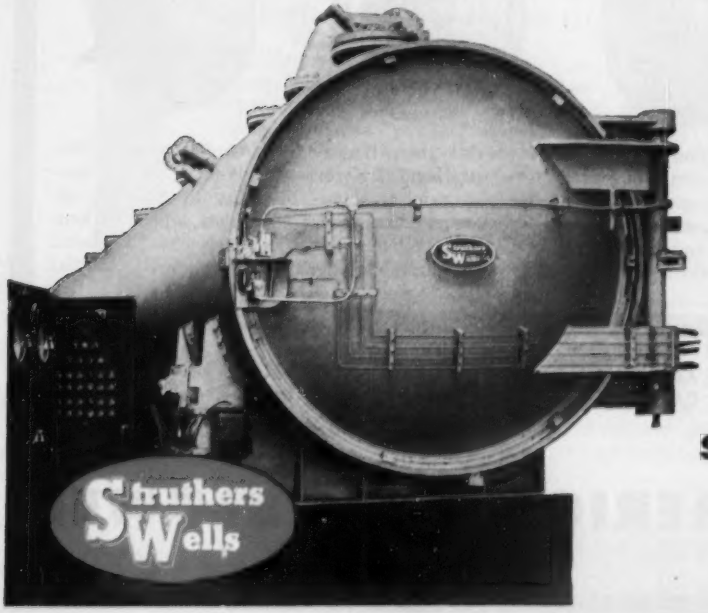


For Horizontal or Vertical Pressure Vessels

Designed and Built to Your Specifications

Struthers Wells' patented engineering achievements provide important advancements in Quick Opening Doors—for all sizes of vulcanizers, devulcanizers, impregnators, sterilizers, ovens, cylinders, etc. These fast, smooth-operating doors feature simplicity of design, ease of handling, savings in floor space, and a lifetime of dependability. Illustrated are a few applications of Quick Opening Doors on large and small vessels. Consult Struthers Wells for doors best suited to your specific requirements.

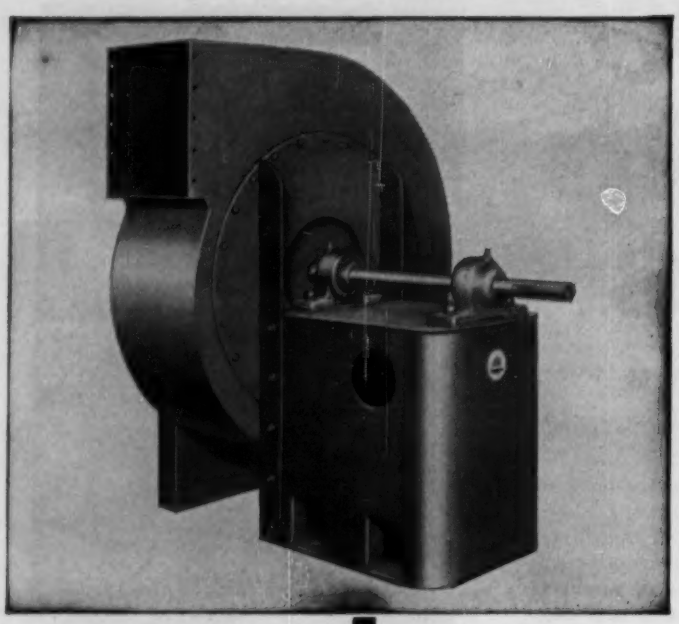
Write for Bulletin SW-553



STRUTHERS WELLS
CORPORATION
TITUSVILLE, PA.
Plants at Titusville and Warren, Pa.
Offices in principal cities

NEW FEATURES! HIGHER EFFICIENCIES! NEW "3-IN-1" DESIGN!

AMERICAN BLOWER SERIES 106 INDUSTRIAL FAN



Series 106 Industrial Fan

Certified ratings! Pressures to 18" w.g.! Volumes to 125,000 cfm! Heavy construction! Choice of 3 special-duty wheels! You get all these features, and many more in American Blower's new Series 106 Industrial Fans.

Available in 16 sizes, each with a high efficiency rating. Series 106 fans offer a wide range of optional accessories and construction features to meet standard or special specifications – *or* you can buy it in 7 sizes as an efficient, heavy-duty "packaged" industrial fan, complete with motor, V-belt drive and weathertight running-gear enclosure.

Get complete data from your nearest American Blower Branch Office, or write for Bulletin 5306-H.

CERTIFIED RATINGS
N A F M
Certified Ratings
CFM

Choose the wheel to fit the duty

Air Handling – for efficient handling of air, fumes, or gases – either clean, or containing light concentrations of dust or materials.

Material Handling – efficiently handles air or gases containing granular material – dust grain, exhaust from buffing or grinding wheels.

Long Shavings – specially designed for conveying or handling air or gases containing long stringy material – wood shavings, fibers, alfalfa.

American Blower products serve industry

- Air Conditioning, Heating, Ventilating Equipment
- Mechanical Draft Equipment
- Industrial Fans and Blowers
- Centrifugal Compressors
- Gyrol Fluid Drives
- Dust Collectors
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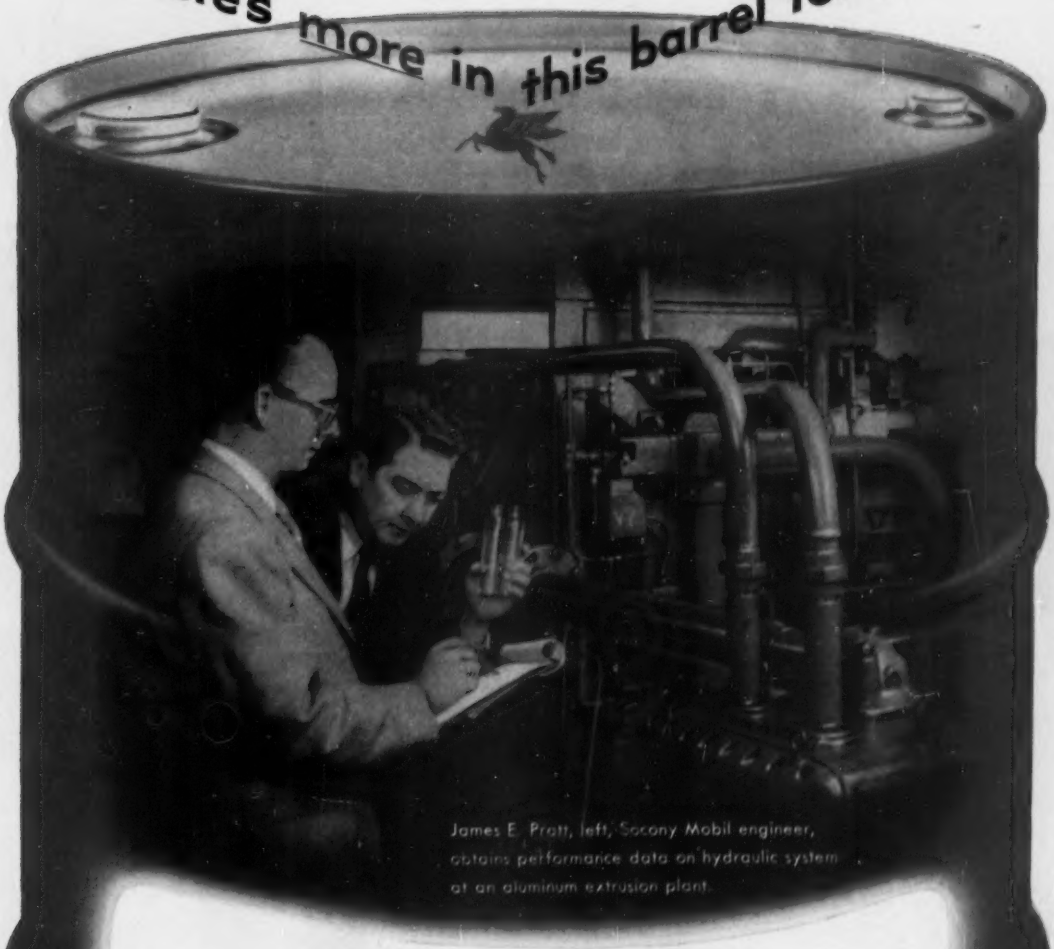
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American-Standard

AMERICAN 75 ANNIVERSARY YEAR 1881-1956 **BLOWER**

There's more in this barrel for you...



James E. Pratt, left, Socony Mobil engineer, obtains performance data on hydraulic system at an aluminum extrusion plant.

MORE ENGINEERS
to help you improve production and cut costs!

Specify Socony Mobil and get the services of more industrial lubrication engineers than are provided by any other oil company.

These specialists, working closely with your Mobil representative, will help you set up a plant-wide program of correct lubrication . . . advise on any lubrication problems that might arise. Their long experience and expert recommendations can improve your production and cut costs.

Socony Mobil products are also backed by *more* services for analyzing petroleum products in use . . . *more* on-the-job training of your personnel in correct product application . . . *more* approvals from machine builders . . . *more* continuous research to assure continually improved products . . . *more* practical experience—90 years!

Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY
SOCONY MOBIL

FIRST STEP
IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

LUBRICANTS • FUELS • CUTTING FLUIDS • WAXES • SOLVENTS • PLASTICIZERS • PETROCHEMICALS

Convert Liquid Chlorine to Dry Vapor Fast and Economically!

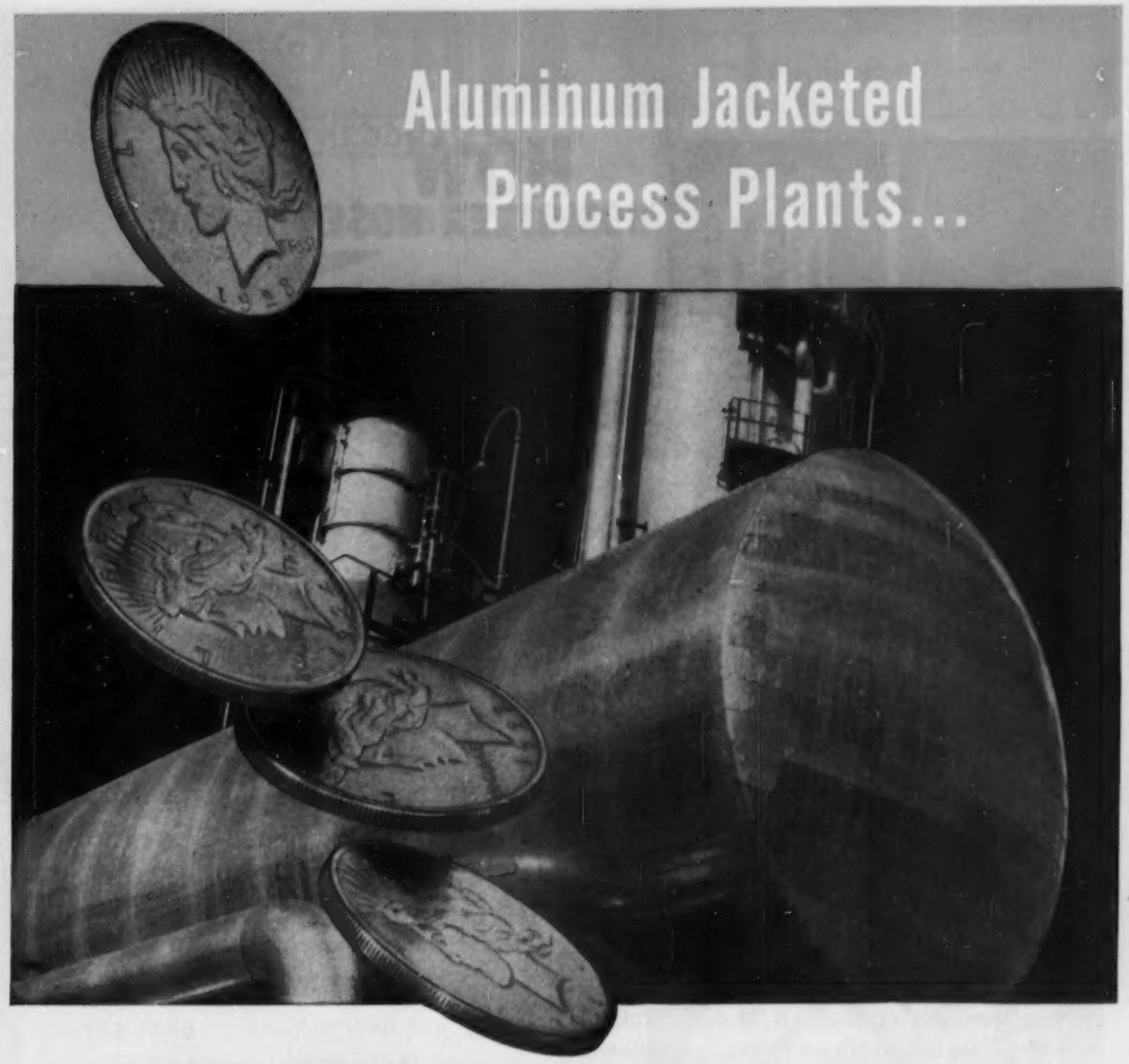
Where relatively large quantities of chlorine in dry gaseous form are required, this Whitlock Vaporizer System provides high capacity output at low cost. The System is standardized in design and complete in itself. To operate, it is only necessary to connect steam, condensate, chlorine, and vent lines. The efficient design and rugged construction suggested by the standards of The Chlorine Institute, Inc., make this System extremely compact and economical. Controls are simple and reliable — assure safe, easy operation.

THE WHITLOCK MANUFACTURING CO.
West Hartford 10, Connecticut
In Canada: Darling Bros., Ltd., Montreal

Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers

The Vaporizer is available in five standard sizes with ratings from 500 to 8000 pounds per hour. Write for descriptive Bulletin 132B and prices.



...Stay Bright as the Dollars You Save

Aluminum resists rust and corrosion due to chemicals, gases, plant atmospheres, coastal environments. You enjoy the natural "bright-as-a-dollar" appearance of this long-lasting metal. You save the expense of painting. You save many dollars on replacement of equipment often destroyed by rust and corrosion.

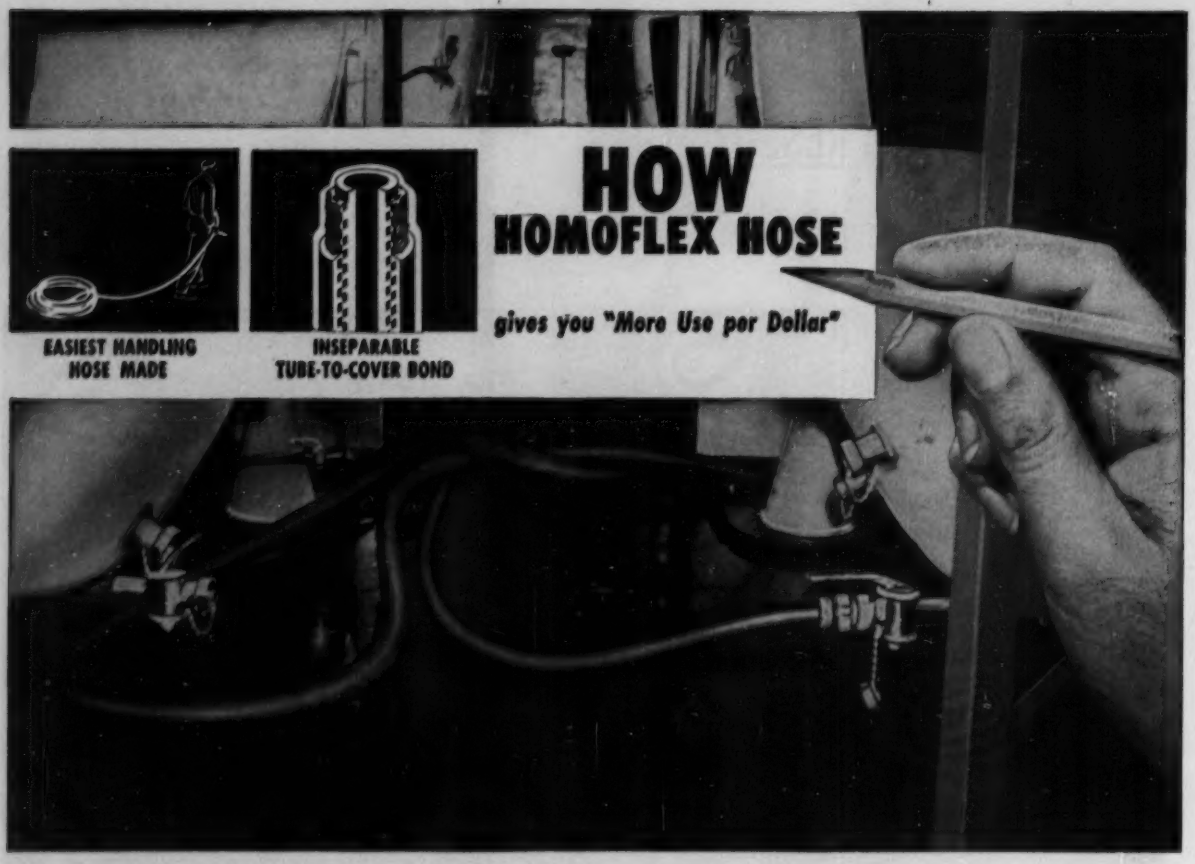
You benefit in other ways, too, with aluminum. It's non-sparking. Eliminates much of the danger of costly fires and explosions. Makes it ideal for walk-ways and tank decks.

Aluminum is versatile. You get natural insulation and high heat transfer from aluminum in many plant uses. Use it for heat exchangers, high pressure steam lines, fractioning towers and many other applications.

Wherever you use aluminum, it remains bright, lasts long, and saves you money. To get more information on aluminum in the process industries, call the Reynolds office listed under "Aluminum" in your classified telephone directory. Or write *Reynolds Metals Company, P.O. Box 1800-CJ, Louisville 1, Kentucky.*

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

Watch for Reynolds new program, "Circus Boy", Sundays on NBC-TV



HOW HOMOFLEX HOSE

gives you "More Use per Dollar"

Many Users Say This Hose Outlasts Them All!

Bulk and stiffness have been engineered out of this modern hose. An exclusive R/M construction, Homoflex Hose has no pre-set twist . . . it coils and uncoils freely in any direction, eliminating strain at kinking points that can cause internal damage and eventual hose failure. Special engineering creates a homogeneous, inseparable tube-to-cover bond that greatly increases hose life . . . and reduces hose costs! Rugged and strong, flexible as a rope, and light, Homoflex Hose does a *better* job in handling air, water, and other fluids and gases . . . and it lasts longer.

Homoflex Hose maintains uniform inside and outside diameters for faster flow on the job . . . easier fitting of couplings. Ask your R/M representative about types of Homoflex Hose for your operations. He can also show you how other types of R/M Hose for general and special purposes last longer, too . . . give you "More Use per Dollar."

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings • Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling

Now . . . NON-PRESSURIZED liquid-phase heat-transfer systems that operate up to 600° F.

AROCLOR 1248

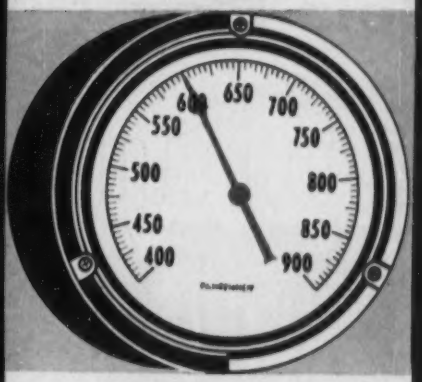
Operates at atmospheric pressure...cuts installation and maintenance costs of expensive pressurized systems.

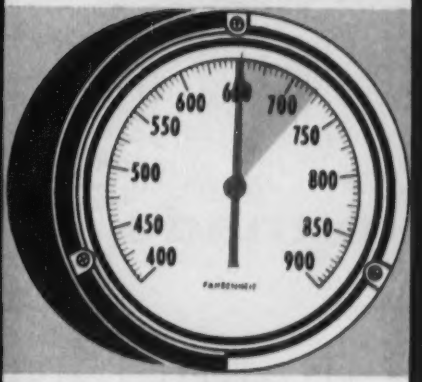
Fluid is fire-resistant... increases safety by eliminating direct-firing or heat transfer with flammable fluids.

The Equipment . . . capacities can range from small portable units—usually electrically heated—to large gas- or oil-fired units generating from 250,000 to over 10,000,000 B.T.U.'s per hour. Circuits are closed, forced circulation. Compact design saves space, minimizes installation and maintenance costs.

The Fluid . . . Aroclor 1248 is a highly stable chlorinated polyphenyl; does not support combustion up to its boiling range 652° to 725° F.; has autogenous ignition temperature of extremely high 1299° F.; is non-corrosive. Aroclor 1248 operates in most systems four to seven years without replacement.

Performance Qualities of Aroclor 1248





Boiling range 652° to 725° F. Assures liquid condition at all times.

Pin-point control within 2° F.

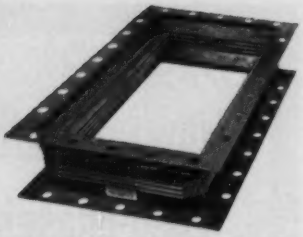
MONSANTO

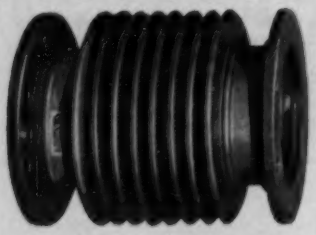
Where Creative Chemistry Works Wonders for You

Contact Monsanto for SOURCES of AROCLOR 1248 heating systems

Write to us on your company letterhead. We will send you technical information about Aroclor 1248 and/or the names of Aroclor 1248 heat-transfer system manufacturers and designers. Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. IF-3, St. Louis 1, Missouri.

AROCLOR: Reg. U. S. Pat. Off.

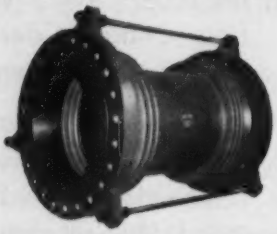
Sola-Flex bellows 



and expansion joints

are made in all sizes

and varieties



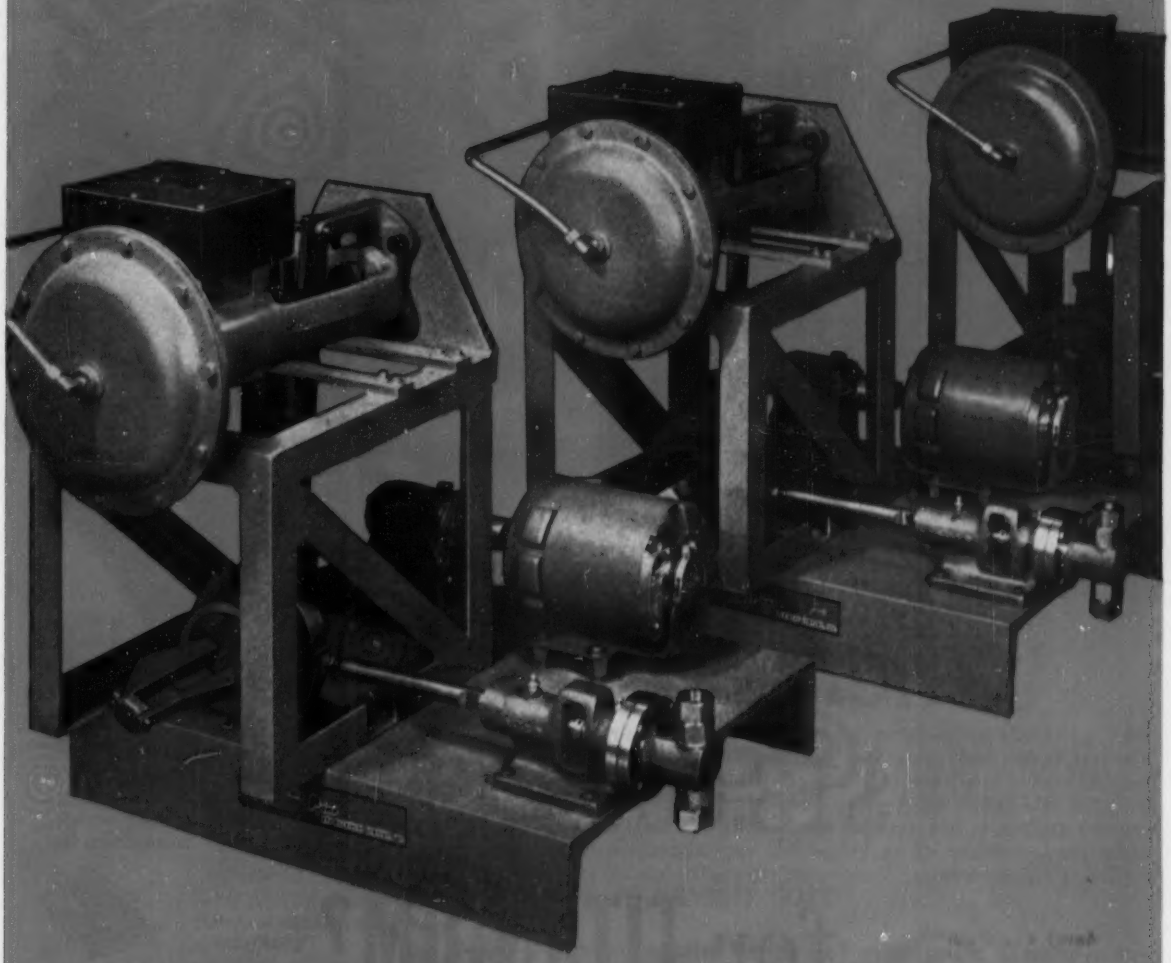
SOLA-FLEX JOINTS AND BELLOWS

BIG OR LITTLE, round or square, convoluted or U-span—no matter what kind of expansion joints you need, Solar can build them. Sola-Flex joints are durable, economical, and are based on advanced engineering designs using a wide variety of metals. High or low pressure piping problems are easily solved with Sola-Flex bellows. Ask for our latest catalog. Write Dept. C-71, Solar Aircraft Company, San Diego 12, Calif.

SOLAR
AIRCRAFT COMPANY
SOLAR
SAN DIEGO DES MOINES

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF METAL ALLOY PRODUCTS • GAS TURBINES • BELLOWS • CONTROLS • HIGH TEMPERATURE COATINGS • AIRCRAFT COMPONENTS

Pumping Corrosion Inhibitors..



..with metering accuracy of 0.2%

thanks to **PHILATROL***

AUTOMATIC CAPACITY CONTROL

* Illustrated, pneumatically motivated with built-in square root extractor requiring 3 to 15 lb. signal. Also available electrically motivated—50 or 100 ohm slide wire. Hydraulically motivated —50 to 100 p.s.i. hydraulic fluid.

PHILADELPHIA PUMPS

PHILADELPHIA PUMP & MACHINERY CO. / Philadelphia 18, Pa. / Subsidiary of American Meter Co.

when should you pay $13.00* a pound for TITANIUM?

The answer is *when its cost/life ratio makes titanium less costly than other metals*—as it often does. Look at it this way . . .

More Metal Per Pound—Titanium weighs only 56% as much as steel of the same strength. Where 50 pounds of steel is needed—28 pounds of titanium will do the job.

It's Final Cost That Counts—Fabricating takes the lion's share of production costs on most jobs. Considering material and fabricating costs together usually whittles down the titanium price differential to 2 or 3 to 1. And, most important . . .

Titanium Outlasts Most Metals—even those generally considered 'corrosion-resistant,' by 10, 20, even 50 times or more.

Added together, these facts often make titanium the most inexpensive material you can use. And only titanium can provide its exceptional combination of *light-weight, high-strength,* and *resistance to corrosion.* Ask a REM-CRU engineer to give you complete details about what titanium can do for you.

**The actual cost of titanium mill products varies with the grade, size and quantity ordered. The $13.00 figure is representative of today's prices for items used in commercial applications.*

To keep abreast of the latest developments on this vital metal, write to Dept. C-10 for the Rem-Cru Review—a free periodical presenting the latest technical data on titanium alloys.

REM-CRU TITANIUM

REM-CRU TITANIUM, INC., MIDLAND, PENNSYLVANIA

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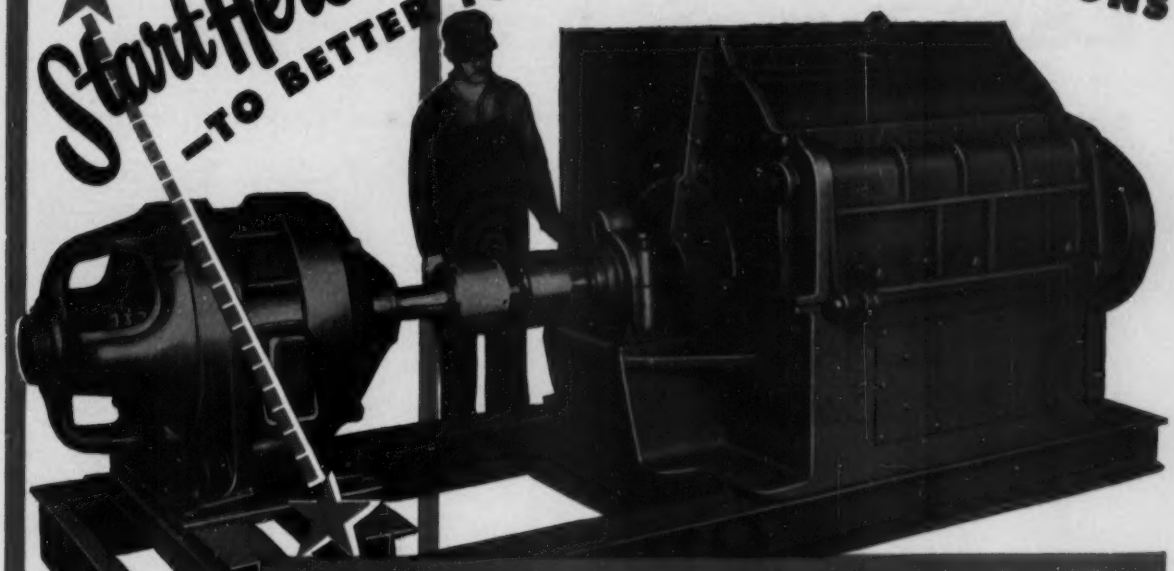
Start Here —TO BETTER YOUR GRINDING OPERATIONS



WILLIAMS *Heavy Duty* HAMMER MILLS

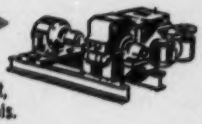
OTHER WILLIAMS EQUIPMENT

▲ ROLLER MILLS
—IMPACT and DRYER MILLS
—for fine grinding to 400 mesh or micron sizes

▲ AIR SEPARATORS
—any type; for precision control and high production in fine grinding

▲ VIBRATING SCREENS
1 to 3 decks, —in any size for any job. open or enclosed.

HELIX-SEAL MILLS ▶
—for dust-free grinding, and for wet, sticky, greasy materials.



Also: COMPLETE "Packaged" PLANTS for crushing, grinding, separating.

★ **INCREASE YOUR OUTPUT**
★ **IMPROVE PRODUCT QUALITY**
★ **REDUCE YOUR COST-PER-TON**

★ No matter how tough your grinding, crushing or shredding job—no matter what the material; mineral, vegetable, chemical or animal—there's a Williams Hammer Mill engineered especially to get the finished product you want in a single operation—A SAVING UP TO 50% IN PRODUCTION COSTS! Extra primary and secondary crushers are unnecessary—foundations and buildings for additional machines, drives, conveyors and other equipment are eliminated—A SAVING UP TO 75% IN EQUIPMENT COST!

Many Williams exclusive design and construction features assure greater accuracy to meet the most difficult product specifications—and promise continuous satisfactory performance under the most severe operating conditions with an absolute minimum of maintenance.

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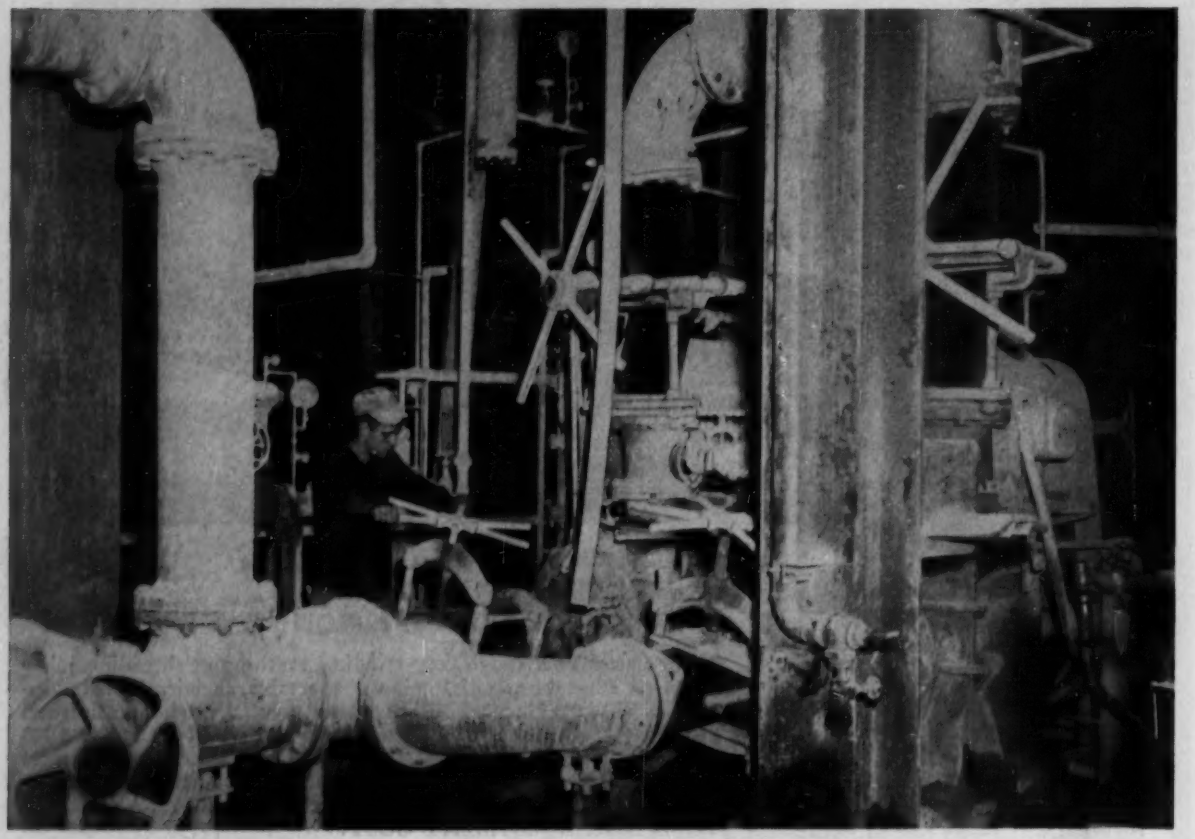
CRUSHERS GRINDERS SHREDDERS

OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

"U. S. Pilot Pinch Valves Last Twice As Long..."

says production official of phosphate chemical plant



"And these U. S. Pilot® Pinch Valves," he adds, "don't clog or freeze – they are made of rubber. They don't require the babying of metal valves—and they play a major part on our production." Although the life expectancy of these "U. S." valves is twice that of metal valves they cost less to install.

This phosphate plant, located in Florida, manufactures animal food supplements and fertilizer. It is in operation 24 hours a day, 7 days a week. In this rugged round-the-clock routine, "U. S." products have proved economical and highly satisfactory. To control, pipe and connect the highly corrosive and erosive semi-solids handled in the plant, U. S. Giant® Acid Hose, U. S. Expansion Joints and U. S. Pilot Flexible Pipe are used. The plant's officials have found that U. S. Rubber products are unmatched in facilitating production and in reducing maintenance and equipment charges. They have standardized on "U. S." products. It will pay you to take any and all corrosion problems to a "U. S." specialist.

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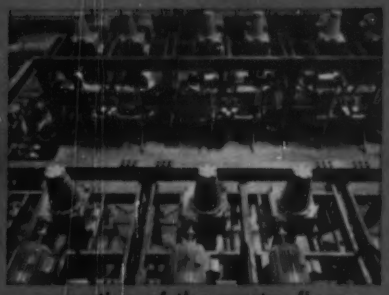
US RUBBER

Mechanical Goods Division

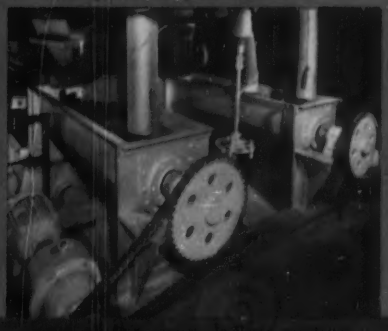
United States Rubber

California Spray Chemical Corporation's new Complex Fertilizer Plant at Richmond, California which will shortly go on stream rated capacity is 400 tons-per-day. The new plant was designed by C & I and is the first of its type in the Western Hemisphere using the PEC continuous chemical processes. Wide range and flexibility are provided, and most any desired grade of fertilizer can be produced. This process was selected by Calspray after careful research and comparison of all available processes.



a portion of the reactor floor showing acidulating vessels

gigantic rotary driers condition pelleted plant food



[C I]

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Designers and Builders of Plants for the Processing of Ammonia—Available Throughout the World

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When all the shouting is over and the last campaign speech has been made, isn't this what all the struggle is really about?

You and your neighbors are going to march to the polls November 6 and settle things the American way.

Not by fists or by force, not with a penalty if you don't vote, or the secret police checking up to see if you did.

You'll vote because it's the thing to do.

Vote as you please, of course—but vote.

Vote for the party and the candidates you honestly believe will represent you best.

But also vote because you believe in this democracy of ours and you want to keep it the way it is—a country where you can have your say and nobody else can say it for you.

Everybody you know will be there.

We'll see you at the polls.

THE AMERICAN HERITAGE FOUNDATION

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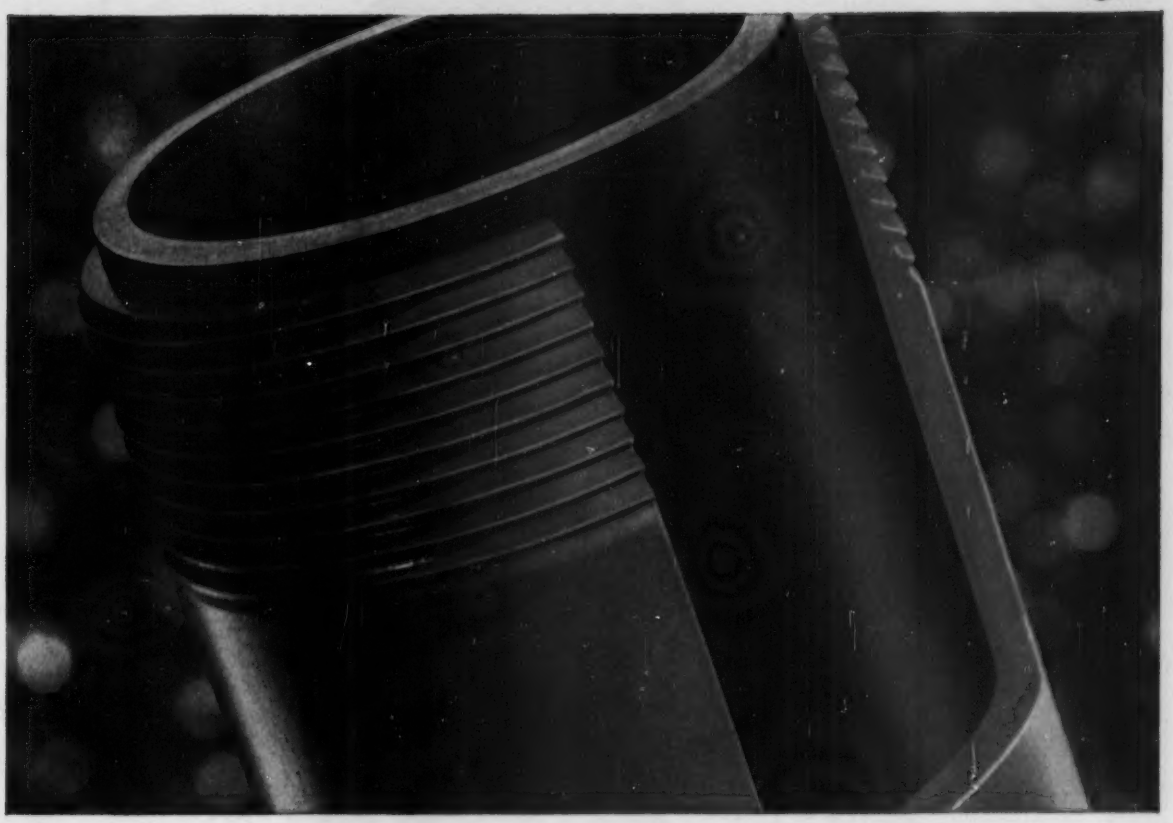
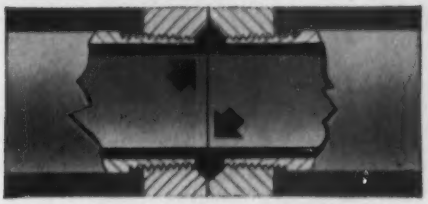
VOTE NOVEMBER 6th!

DOW



You can see why Saran Lined Pipe cuts corrosion costs



Liquid never touches metal in saran lined pipe even at a flanged connection like this.

It's made of corrosion-resistant saran swaged into rigid non-bursting steel . . . liquid never touches metal in these installations

Here's your best way to convey acids, alkalies and other corrosive liquids—saran lined pipe, fittings and valves. This modern piping is corrosion resistant . . . forms snug, leakproof joints . . . is available for working pressures up to 150 psi. Fittings and valves are also available in steel for working pressures to 300 psi.

Installation costs are low with saran lined pipe, fittings and valves. Saran lined pipe can be cut and threaded in the field with available pipe-fitters' tools. Its rigidity means few supporting structures are needed.

Saran lined pipe has an outstanding record of trouble-free performance in the chemical, petroleum, waste, pulp and paper, metal finishing, and food processing industries. For further information send in the coupon at the right. THE DOW CHEMICAL COMPANY, Midland, Michigan.

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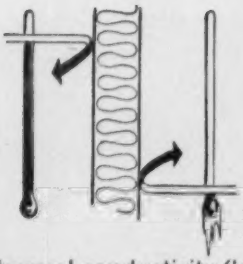
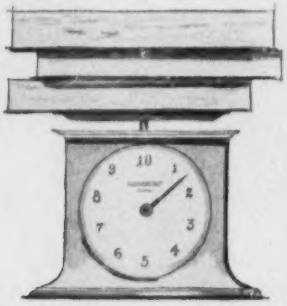
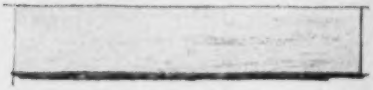


Low thermal conductivity (k) permits use of lesser thicknesses!



Lightweight Fiberglas blocks offer economical installation, easy maintenance!



Dimensionally stable, inorganic fibers of glass will never rot, corrode, settle!

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. . . distributed by approved Fiberglas distributor-contractors . . . offer the most versatile family of plant insulations available, in the widest range of shapes, sizes and thicknesses for every type of industrial application. With new *pink* Kaylo-*20* insulation serving the extra-high temperature ranges, you can now order—from *one* reliable supplier—complete insulation coverage *from lowest sub-zero to 1800°F.!* See *Sweet's Files, Chemical Engineering Catalog* or *The Refinery Catalog*. Or write: Owens-Corning Fiberglas Corporation, Dept. 97J, Toledo 1, Ohio.

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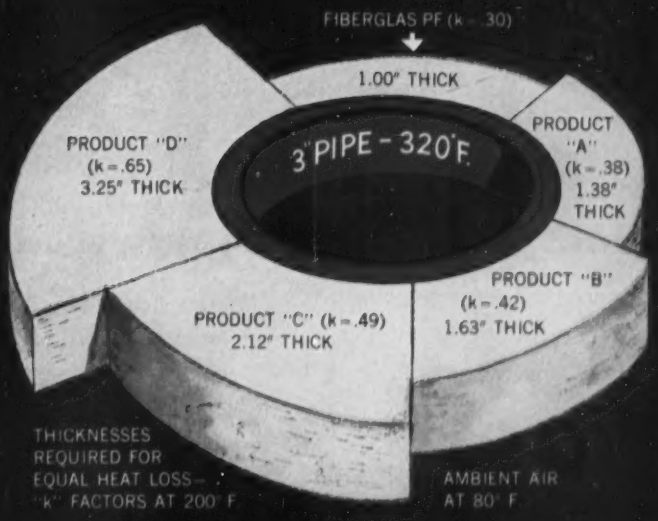
FIBERGLAS PF (k = .30)
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PRODUCT "D" (k = .65) 3.25" THICK
3" PIPE - 320° F
PRODUCT "A" (k = .38) 1.38" THICK
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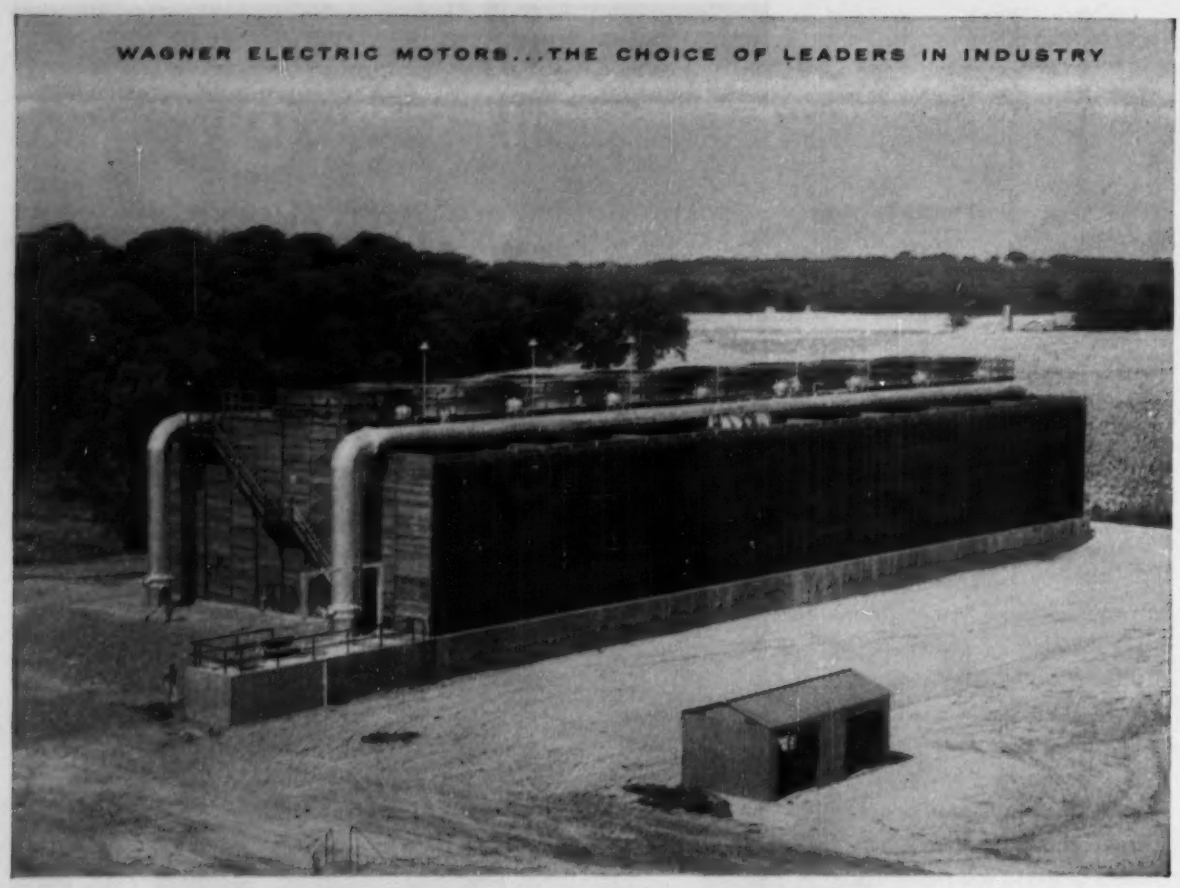
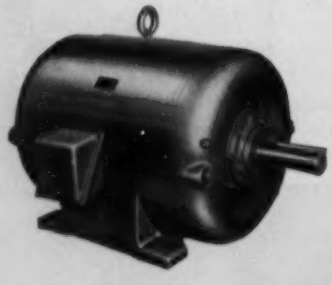
for insulating efficiency!

WAGNER ELECTRIC MOTORS...THE CHOICE OF LEADERS IN INDUSTRY



Giant Water Cooler—powered by Wagner Motors



Wagner Type EP—Totally-enclosed fan-cooled motor. Corrosion-resistant frame. 40 to 250 hp.

Marley Cooling Tower cools 44,000 gallons of water per minute for The Kansas Power and Light Company

This eight cell cooling tower for a power company steam plant supplies a constant flow of cooling water to lower steam pressure beyond the turbine to get more kilowatts per pound of steam.

Each of the eight 240 inch fans in this tower is driven by a 50 hp Wagner totally-enclosed fan-cooled motor.

Wagner type EP Motors are well suited to rugged, hard driving, outdoor applications like this. Their totally-enclosed, corrosion-resistant cast iron frame construction protects them from the elements. They have the winding strength required to stand the shock of starting heavy loads repeatedly and the mechanical and electrical stamina to keep operating, without attention, day after day.

This exacting application is one of many where specialized requirements are met from the complete line of Wagner standard motors.

Whatever your requirements may be, there is a Wagner Motor to fit every need—a complete line for all current specifications, with a wide variety of enclosure types and mountings. Your nearby Wagner engineer can help you select the *right* motors for your needs. Call the nearest of our 32 branch offices, or write for Bulletins MU-132 and MU-203.

Wagner Electric Corporation
EST. 1891

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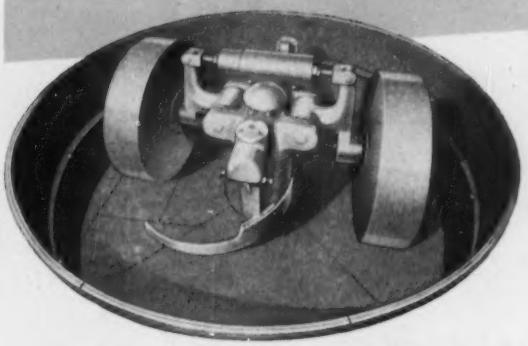
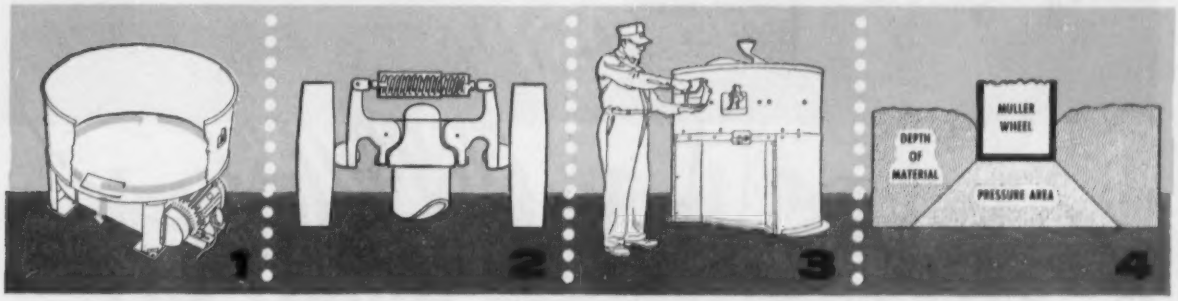
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

Here's why SIMPSON MIX-MULLER® is today's BEST BUY in MIXING EQUIPMENT



Interior crib detail of Model 3F; 50 to 60 cu. ft. batch capacity Mix-Muller.

The advantage of preparing dry, wetted or plastic materials in a Simpson Mix-Muller is written in *savings*. Controlled mixing *cannot fail* to result in thorough, effective utilization of raw materials. Adequate control over moisture alone can mean the difference between an unwieldy reject ratio and a profitable mixing operation. Four outstanding features of the Simpson Mix-Muller play an important role in the kind of control over product quality so necessary to return profit from manpower, machinery and materials. See how they are designed to save you time, labor, material, power, maintenance and *money*:



1. BOTTOM DISCHARGE • STATIONARY PAN

Mix-Muller power is used to *mix* . . . none is wasted to move machinery or material mass. Muller and plow action clears pan quickly, thoroughly.

2. SPRING LOADED MULLERS

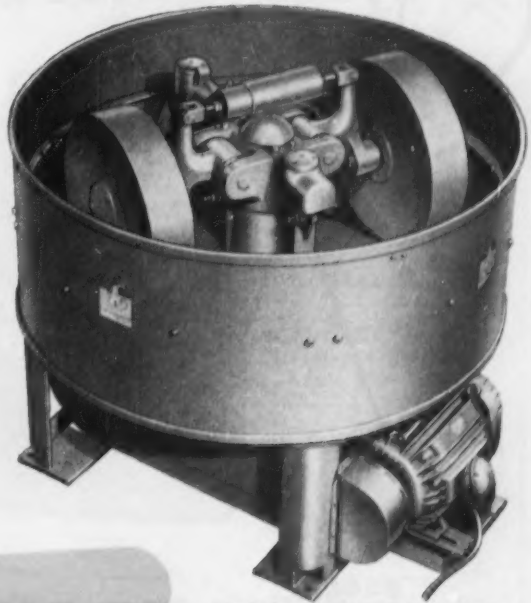
. . . allow muller pressure to be adjusted to the type and density of materials to be mixed. You reduce mulling time, build desired properties faster.

3. SAFE, EASY to OPERATE and MAINTAIN

You get large batches prepared in minutes. Design is simple, rugged. *Intense*, but slow speed, action extends machinery wear life. Maintenance people *welcome* the self cleaning action.

4. MOST THOROUGH MULLING ACTION EVER DEVELOPED

Thorough dispersion affords high yield of even trace elements and optimum utilization of mixing properties. High muller pressure to area ratio (see chart) assures *most* mulling per revolution.



Model 2F; 20-25 cu. ft. Mix-Muller. Note unit drive—easy adaptability for dust hood or exhaust. It's *built* to be integrated into a materials handling or continuous mixing system!

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EAGLE-PICHER
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- Saves time, work, money! Just one application insulates, protects, finishes *hot or cold* equipment. Provides smooth, light reflectant surface.
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- For outdoor installations! Quick-setting, withstands rain and moisture two hours after application. Prevents rust, too!
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Prove to yourself, on your own equipment, how Eagle-Picher One-Cote Cement can save you time, money and valuable man-hours!

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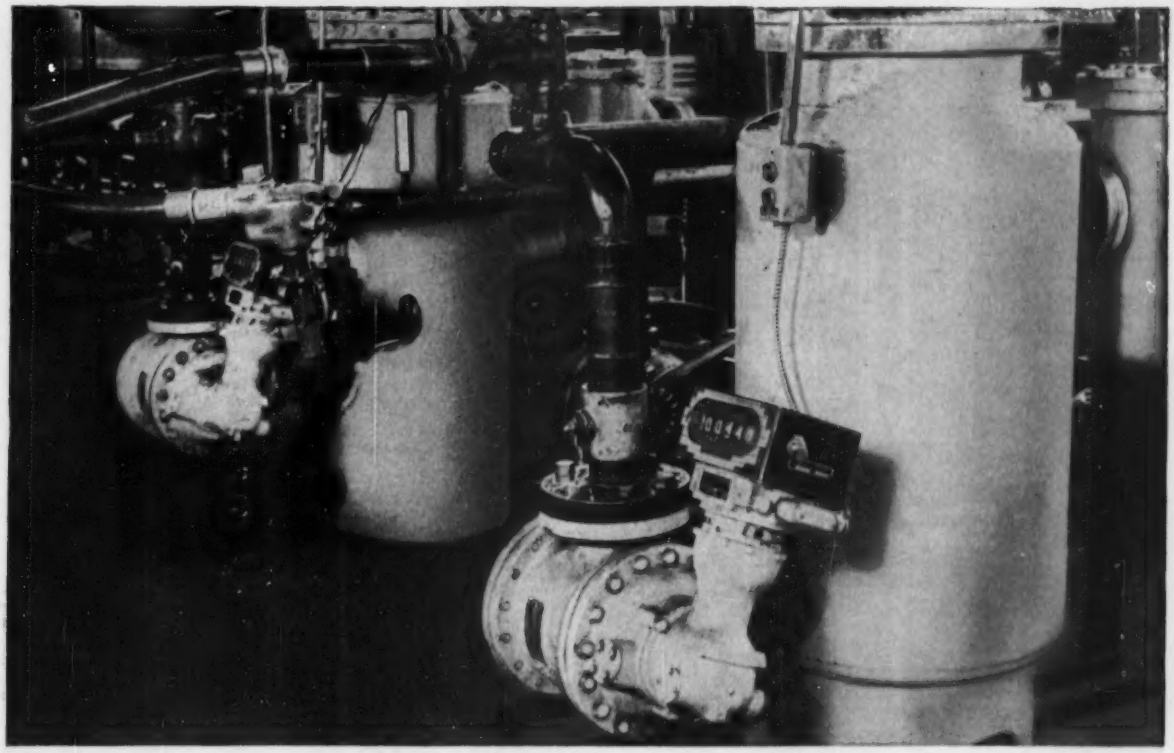
Mineral wool, magnesia and other insulations for all temperatures from below 0 F. to over 2000 F.



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With Rockwell Industrial Meters you will eliminate the human error in handling liquids and compounding formulas. By supplanting time consuming weight or gauge methods, you'll save money. With a closed metered piping system you can avoid hazards and contamination. And remember, since Rockwell meters are available in a wide variety of metals (including stainless steel) you can measure most any liquid that can be piped. Let our engineers advise on your services. Write or use the handy coupon.

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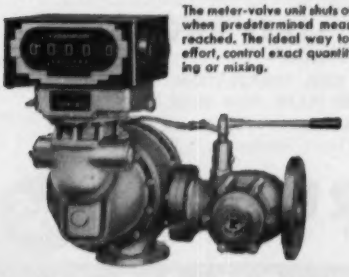
Give Accurate Measurements—Fast!

Durable, All-Metal Construction In

STAINLESS STEEL BRONZE ALL-FERROUS STEEL

Automatic Quantity Control



The meter-valve unit shuts off automatically when predetermined measured volume is reached. The ideal way to save time and effort, control exact quantities when batching or mixing.

Provides Pre-Set Meter Shut-off Without Shock!

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I am interested in measuring _____
(Name of Liquid)

Pipe Size _____"

Working Pressure _____ psi Temperature _____ °F max.

Max. Flow Rate _____ gpm Min. Flow Rate _____ gpm

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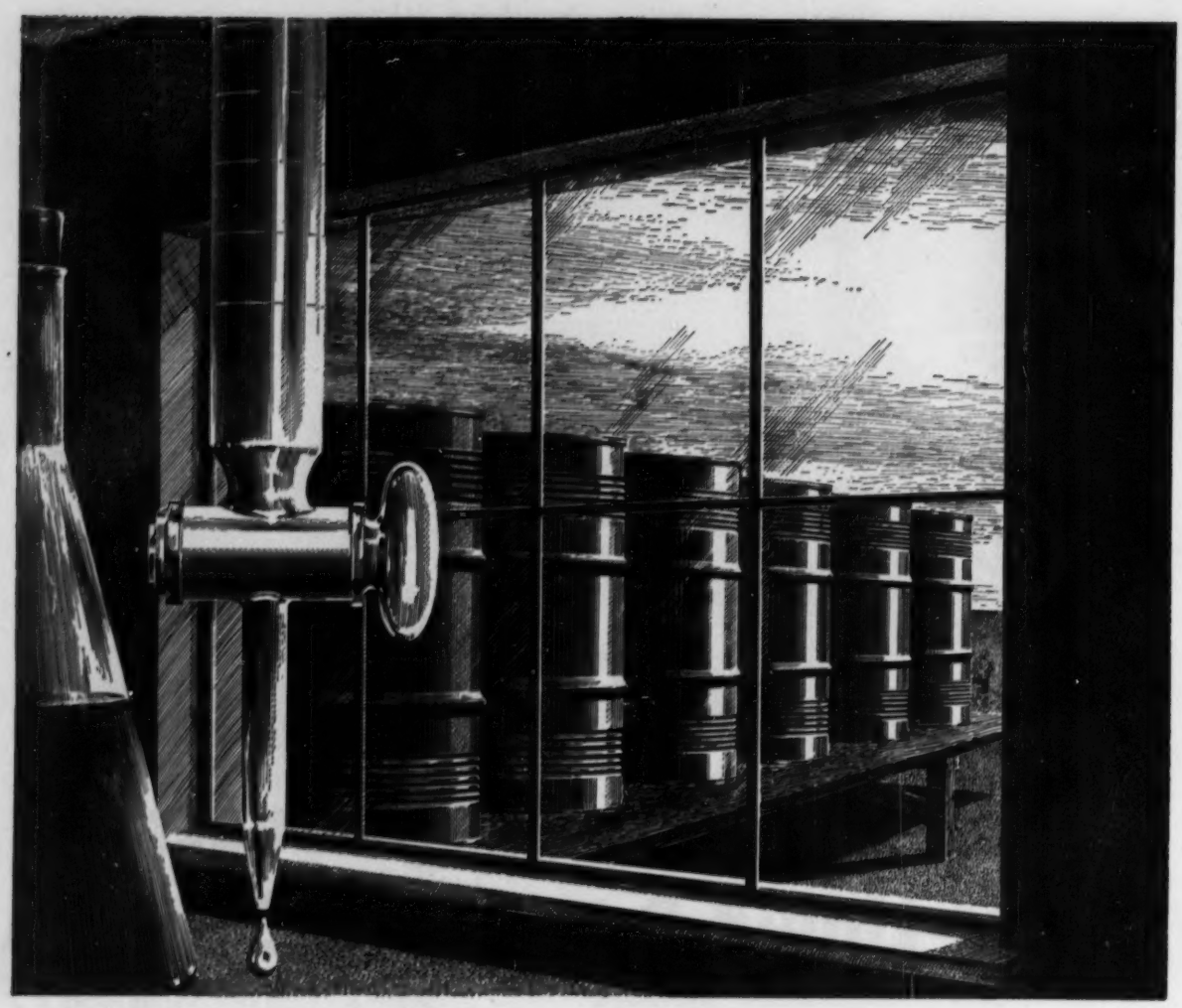

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Shipping in USS Steel Drums means maintaining your own rigid quality control measures right into your customer's plant. Special measures taken in the manufacture of USS Steel Drums make them able to act as a rolling Fort Knox, keeping your product clean and pure—all the way.

To protect your product against contamination, every drum-body, head and bottom is freed of ALL manufacturing dirt, grease and scale. With component parts virtually "hospital clean" the drum-parts are ready for the final step. This consists of applying all inside and outside surfaces with a special phosphate solution that inhibits rusting and serves as an excellent bond for external paint application. The USS Steel Drum is ready for its job of protecting your product from contamination.

USS Steel Containers are available in sizes from 2½ to 110 gallons . . . with a wide variety of special fittings and openings to answer any need. Always specify product-protecting USS Steel Drums.

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An important new source of supply and service is brought to the plastics industry when Escambia Chemical begins production of Polyvinyl Chloride Resins this year.

Products of highest quality and uniformity will be manufactured under constant technical supervision in Escambia's modern plant.

A well staffed and fully equipped customer and technical service laboratory is a major service offered by Escambia. Here, Escambia is conducting research on products and technical service problems for customers.

The first product—a general purpose, easy processing Polyvinyl Chloride Resin—will be in production this year for use in the calendering, extrusion and molding industries. Following this, Escambia will produce a molecular weight range of straight PVC Resins including types for electrical and rigid applications.

In its role as a dependable source of raw materials, Escambia is geared to make its contribution to the rapid progress of the plastics industry.

ESCAMBIA CHEMICAL
CORPORATION

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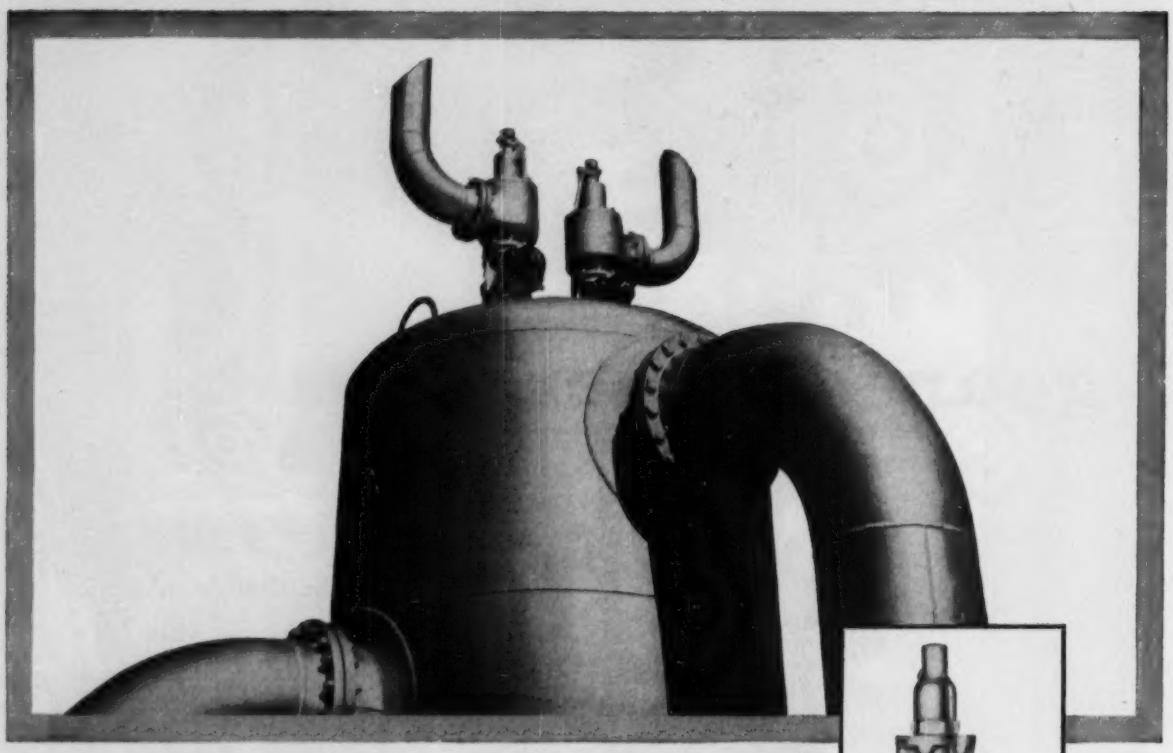

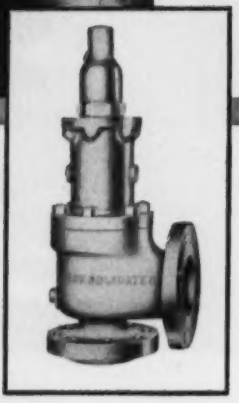

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★ **Absolute Protection**
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CONSOLIDATED SAFETY RELIEF VALVES GIVE YOU ALL FOUR—AND MORE

Consolidated Safety Relief Valves satisfy *every* requirement of the most advanced processing facilities. Valve action is *consistently* positive. You get peak performance even where discharge lines are long or there is low "superimposed" back pressure in the relieving system!

The Standard type can be converted to Bellows type *in the field*. Center-to-face dimensions of inlet and outlet are such that you can interchange these valves with the safety relief valves of other manufacturers. Real flexibility of application that cuts inventory costs! Optically-ground flat seating surface and fewer functional parts than comparable valves contribute greatly to easier, more economical maintenance.

Get top economy and absolute protection with Consolidated Safety Relief Valves. Full range of sizes and pressures available. Write for Catalog 1900 for complete information.

CERTIFIED AND APPROVED. Both Standard and Bellows Valves are approved under API-ASME and ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.

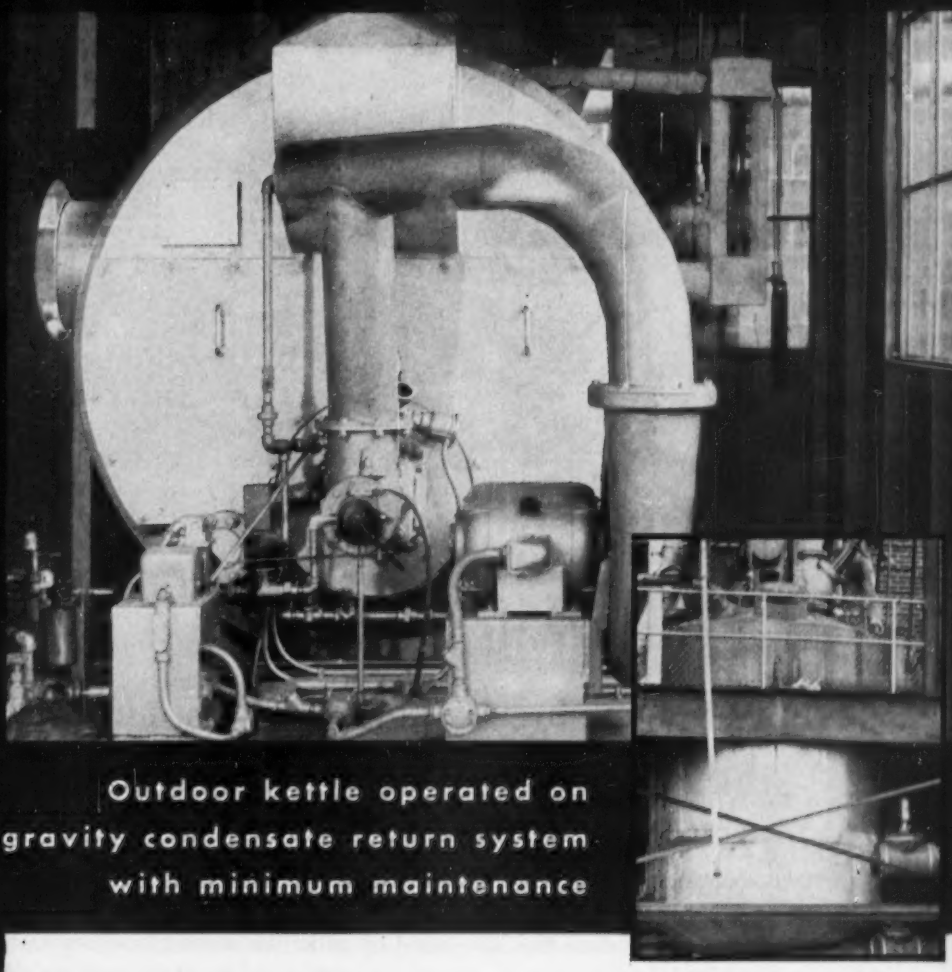
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

CONSOLIDATED SAFETY RELIEF VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** TULSA, OKLAHOMA

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

Eclipse 4,000,000 BTU Dowtherm Vaporizer Cooks Synthetic Resins at 40 psi



Outdoor kettle operated on gravity condensate return system with minimum maintenance

Synthetic resin production at Canadian General Electric Co., Toronto, posed a maintenance problem because an outside Dowtherm return pump was operated in the open air. Past performance of other Eclipse units at this plant proved the problem could be solved economically by an Eclipse Dowtherm Vaporizer. Synthetic resins produced consist largely of alkyd resins, using vegetable oils, pthalic anhydride, and polyols.

Engineers selected an Eclipse 4,000,000 Btu horizontal fire-tube Dowtherm Vaporizer because its low liquid level allowed a gravity return of Dowtherm from the process vessel. This oil-fired unit operates at 620F and at 40 psi pressure. The process equipment is positioned high enough above the liquid level in the vaporizer to permit this system to operate with gravity return of condensate. Pumps or traps are eliminated and there are no rotating shafts or stuffing boxes to leak.

Investigate Eclipse Dowtherm Vaporizers when you have a process heating problem that requires: high temperatures and low pressures, precise control of temperature, low stack temperatures, high heat transfer rate, or minimum maintenance. Your Eclipse field engineer will help solve your problems with process heating equipment from Canada's most complete line.

Eclipse®

ECLIPSE FUEL ENGINEERING CO.
1121 BUCHANAN STREET, ROCKFORD, ILLINOIS
ECLIPSE FUEL ENGINEERING CO. OF CANADA LTD., 31 UPJOHN ROAD, DON MILLS, ONTARIO

$AVE UP TO 91¢ *of every* $1.

INVESTED IN CORROSIVE FUME HANDLING

SEE HOW "BUFFALO" RUBBER-LINED EXHAUSTERS ARE DOING IT IN HUNDREDS OF PLANTS

Fumes from many processes destroy ordinary steel plate exhausters far earlier than normal life expectancy — and fan replacement is a major expense.

"Buffalo" Rubber-Lined Fans save you this expense. All exposed parts are protected by a layer of rubber "welded" permanently to the steel. *Corrosive fumes cannot contact the metal.* Small wonder these fans have stood up under the severest fume services anywhere from 3 to 12 times longer! Savings far more than pay for the cost of the rubber lining, to say nothing of reduction in down-time. It's just one more example of the "Q" Factor* that saves you money in all "Buffalo" Fans.

If you have fume exhausting installations, it will pay you to check fan replacement and down-time costs, and see how "Buffalo" Rubber-Lined Exhausters could be saving you money.

WRITE FOR BULLETIN 2424-F TODAY!

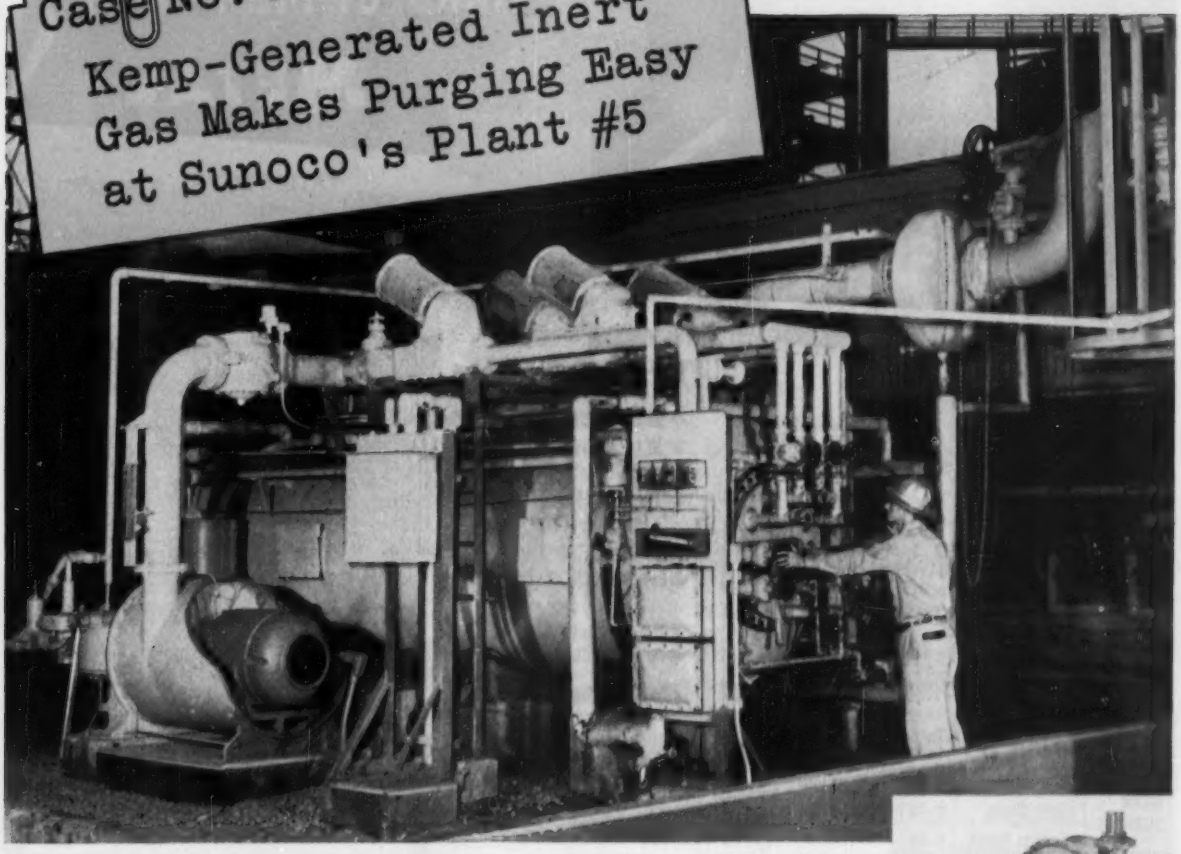
**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY
BUFFALO, NEW YORK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Case No. 57
Kemp-Generated Inert Gas Makes Purging Easy at Sunoco's Plant #5



How Sun Oil's "Magic Mill" at Toledo operates with 'round the clock safety

There's no *one* word that strikes terror in the hearts of oilmen everywhere more quickly than F-I-R-E! To combat this threat at the Sun Oil Co.'s giant refinery at Toledo, Ohio, constant vigilance, checks and inspections are the answer. And the liberal use of inert gas for purging pipelines, tanks and crackers is essential to this safety maintenance.

Kemp selected to do the job

When plans called for *doubling* plant production in 1950, a new Kemp Generator (see above) was installed to insure adequate inert gas production. Fast-starting, easy-to-operate, this Kemp unit more than filled the bill. Today tanks and lines are periodically purged for inspection and cleaning *as often as needed*. And thanks to its 60,000 cu. ft. per hr. Kemp Inert Gas Generator, Sunoco enjoys *exact analysis* inert production that meets all its purging requirements.

Let Kemp help you, too

If you have a purging or blanketing problem, why not let Kemp Engineers give you the same helpful advice used so profitably at Sun Oil's Toledo refinery. It costs you nothing to investigate. And it may save you money. Find out how Kemp's wide range of dependable, low-cost Generators (complete with the latest fire checks and safety devices) offer you the best way to solve your problems.

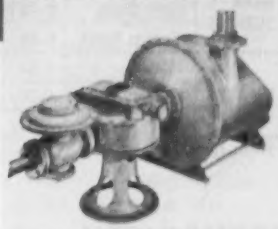
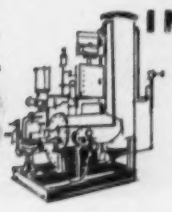


Photo above shows close-up view of Kemp Industrial Carbureter, the heart of every Kemp installation. Assures complete combustion... without waste, without tinkering. Reduces installation costs, simplifies maintenance.

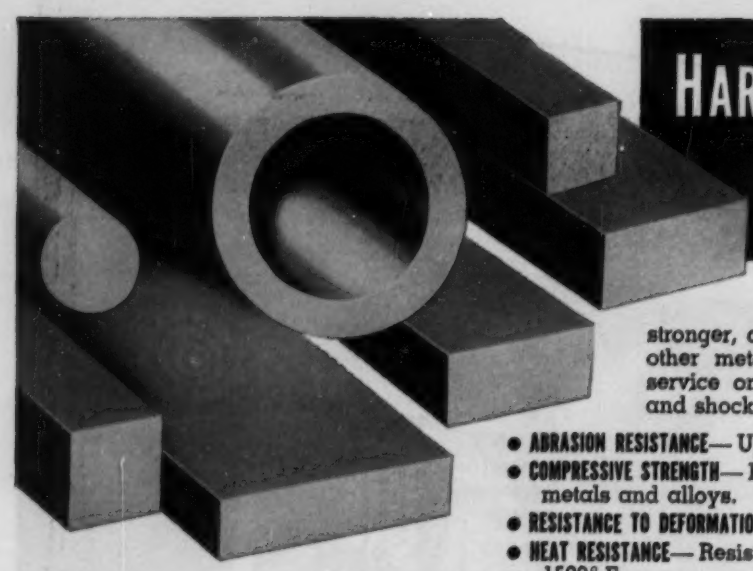
For more complete facts and technical information, write for Bulletin I-10 to C. M. KEMP MFG. CO., 405 E. Oliver Street, Baltimore 2, Maryland.

KEMP OF BALTIMORE



INERT GAS GENERATORS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • ADSORPTIVE
DRYERS • SINGEING EQUIPMENT



HARDEST MAN-MADE METAL

TALIDE METAL, a tungsten carbide of superior quality, is harder, stronger, and more resistant to abrasion than any other metal. Properly applied, it gives superior service on applications where wear, heat, strain and shock are destructive to other metals.

- **ABRASION RESISTANCE**— Up to 100 times that of steel.
- **COMPRESSIVE STRENGTH**— Higher than all melted, cast or forged metals and alloys.
- **RESISTANCE TO DEFORMATION**— 2 to 3 times greater than steel.
- **HEAT RESISTANCE**— Resists oxidation and thermal shock up to 1500° F.
- **THERMAL EXPANSION**— Less than half the rate of steel, "creep" is negligible.
- **FRICTIONAL RESISTANCE**— Lower than steel, non-galling, "slippery" properties higher.

TALIDE METAL is saving industry millions of dollars annually by wear-proofing vital parts on machine tools, presses, pumps, compressors and other types of processing equipment used in the steel, oil, chemical, plastic, auto, rubber, textile, glass, mining and metal-working industry. The physical properties of the most commonly used grades are listed below. Other grades are available for specialized applications.

PHYSICAL PROPERTIES OF TALIDE METAL (P. S. I.)

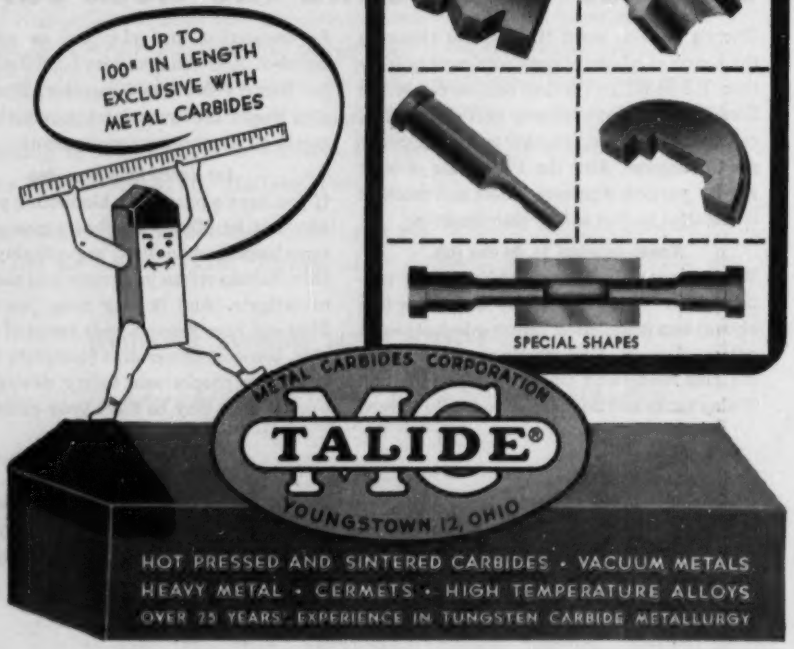
Application	Operation	Talide Grade	Rockwell "A" Hardness	Specific Gravity (Density)	Transverse Rupture Strength	Compressive Strength	Co-Efficient of Thermal Expansion	Modulus of Elasticity (Deflection)
WEAR SURFACE	No Shock	C-91	91.8	14.90	235,000	710,000	3.00x10-6	91,000,000
	Light Shock	C-99	91.0	14.75	265,000	670,000	3.65x10-6	84,000,000
	Medium Shock	C-88	89.5	14.55	295,000	635,000	4.00x10-6	80,000,000
IMPACT	Light	C-85	88.4	14.25	315,000	600,000	3.75x10-6	77,000,000
	Medium	C-80	87.0	13.85	335,000	550,000	4.50x10-6	74,000,000
	Heavy	C-75	85.0	13.15	355,000	500,000	5.00x10-6	70,000,000

Note: Hardness values may vary plus or minus .2 to .3 on individual lots.

All TALIDE METAL grades are made in latest type vacuum electric furnaces by precision methods under rigid control. A wide variety of shapes and sizes can be supplied—up to 25" in diameter, 100" in length, and 5000 pounds by weight. Parts can be supplied to any grit finish required down to one micro-inch.

Metal Carbides Corporation,
Youngstown 12, Ohio.

Send for new 76-page catalog 56-G or ask for sales engineer to call.


UP TO 100" IN LENGTH EXCLUSIVE WITH METAL CARBIDES
METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

Layne Research

7 ways it serves and saves

1. FIELD CONSULTATION: Expert technicians, trained and experienced in all phases of ground water development, are available to Layne clients through Layne associate companies.

2. TRAINING LAYNE PERSONNEL: Layne field operators are trained in new techniques and in the use of materials proved in practical applications as well as in the laboratory.

3. CORROSION PREVENTION: Rust and other corrosion prevention, through the use of properly selected materials for well casings, screens and pumps, including cathodic protection by sacrificial metals and the use of tested resistant paint coatings, are major research developments.

4. REHABILITATION OF EXISTING WELLS: Major expense is often avoided by rehabilitating existing wells and developing new wells by methods initiated in the Research Division.

5. SELECTION OF WELL SCREENS TO WELLS: Well screens, gravels and formation sands are correlated to secure maximum trouble-free water productions with a minimum of screen losses, as the result of Layne Research.

6. IMPROVED WELL CONSTRUCTION TECHNIQUES: Work of the Research Division has resulted in many new materials, including Laynite well cements for sealing well surface casings, Laynite additives for treatment of wells, and Laynite rotary drilling muds.

7. ANALYTICAL STUDIES: Basic research determining corrosion causes, deposition of minerals, micro-bacterial growths, effects of dissolved gases and remedial treatments, is an ever-continuing subject for the Research Division.

Water Wells • Vertical Turbine Pumps
Water Treatment

LAYNE
& BOWLER, INC.
MEMPHIS
General Offices and Factory
LAYNE ASSOCIATE COMPANIES
THROUGHOUT THE WORLD

No matter how you do it, get word to Morton for help in solving any salt problem

The Morton Salt Company offers fast help from salt specialists—at no cost to you. And we mean on *any* salt problem. Morton can help you, whether it be consultation on the best grade or grades of salt for the best, most economical job in any phase of your particular operation . . . or help in planning a new water-softening system . . . or in modernizing or expanding a brine installation.

We can dispatch a Morton Consulting Engineer in your area to your plant. He's an expert when it comes to solving salt problems, and he's backed by the services of chemists and salt scientists at Morton's ultra-modern salt research laboratory. Best of all, these services don't cost you a cent—and they may well save you hundreds of dollars.

Whatever your salt needs, Morton can fill them promptly and economically. Morton produces many grades of salt for use by the chemical industry. Only Morton has nine strategically located plants to serve you. And only Morton can offer fast delivery from a bag to a trainload, at favorable prices and freight, anywhere in the country.

Sending a carrier pigeon is recommended only if you happen to have one familiar with flight patterns to our communications window. The best way to get help, of course, is to write or wire.

MORTON SALT COMPANY
INDUSTRIAL DIVISION
Dept. CE-10, 120 So. La Salle Street,
Chicago 3, Illinois

Perfect answer for processing materials that must be kept from air . . .

DE LAVAL

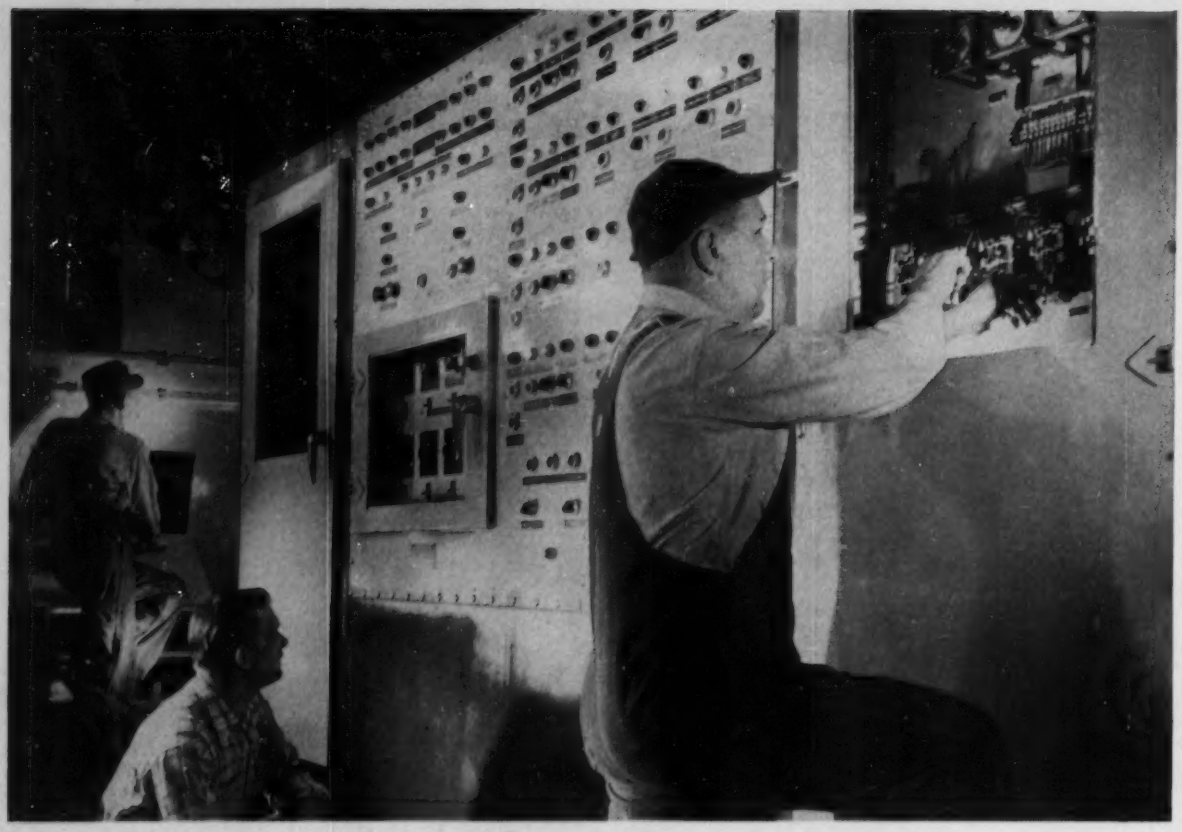
HERMETIC CLARIFIER

Dewey & Almy Chemical Company, Cambridge, Massachusetts, solved the problem of removing undesirable agglomerates from latex without aeration with a De Laval Hermetic Clarifier. The unit has met Dewey & Almy's strict clarification specifications, as determined by conventional visual slide tests.

The De Laval Hermetic effectively clarifies viscous materials . . . doesn't emulsify or aerate because there is no contact with air . . . provides many exclusive advantages.

Find out how a De Laval Hermetic Centrifuge can give you maximum economy and product improvement. ***Write for details . . . today!***

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • **DE LAVAL PACIFIC CO.** 201 E. Millbrae Ave., Millbrae, Calif.



Worked to death... to insure the life of your proportioning system

If there's anything worth its weight in gold in a proportioning system control panel, it's *dependability*. Before a single electrical component was designed into this panel being wired at Richardson Scale Co., its prototype had been literally worked to death in a controlled testing operation. It's survival of the fittest . . . and only the fittest is acceptable. Richardson's reputation as a producer of dependable control panels rests, in the last analysis, on the selection of tested components and on intensive and varied experience in applied electronics.

In addition, Richardson supplies each control panel completely wired and pre-tested, invites the customer to familiarize himself with it *before installation* and takes responsibility for complete system operation. Detailed instructions and diagrams are supplied for each job.

But this is only part of the story. The best of control panels will not pinch-hit for a poor automatic weighing unit, mis-applied materials feeding equipment or improper storage bin design. Richardson know-how in this field embraces 50 years of experience in handling over 400 materials.

When it comes to proportioning, you're in good company when you come to Richardson. Look at some of the others who now have *proportioning by Richardson:*

The Firestone Tire & Rubber Company • General Foods Corp. General Electric Company • U. S. Bureau of Mines Reynolds Metals Company • American Rice Milling Co., Inc. Union Carbide & Carbon Corporation • Ford Motor Co. Fleischmann Distilling Corp. • The Flintkote Company Johnson & Johnson • National Distillers Products Corp. Owens-Illinois Glass Co. • Pittsburgh Coke & Chemical Co. Celanese Corp. of America • Goodyear Tire & Rubber Co. E. I. Du Pont de Nemours & Co., Inc. • and many more.

Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

RICHARDSON SCALE COMPANY
Clifton, New Jersey

Atlanta • Boston • Buffalo • Chicago • Cincinnati • Detroit Houston • Memphis • Minneapolis • New York • Omaha Philadelphia • Pittsburgh • San Francisco • Wichita • Montreal Toronto • Havana • Mexico City • San Juan

Richardson Scales S.A. 1-3 Rue de Chantepoulet, Geneva, Switzerland

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living ... Through Chemistry

CHEMICAL ENGINEERING NEWS

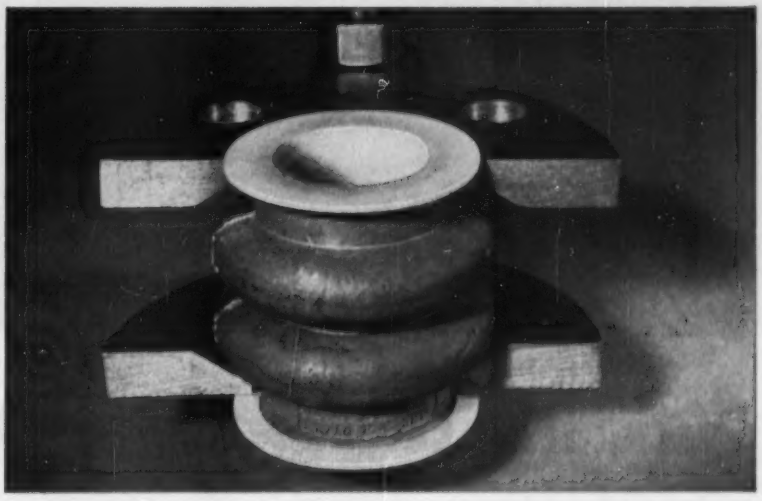
PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

Expansion joints of TEFLON® are chemically inert – exceptionally strong

Process lines of ALATHON® are flexible, durable and chemical-resistant

Pipe and process lines of "Alathon" polyethylene resin offer outstanding ease of installation and durability. Process lines of "Alathon" couple quickly without the use of threading – all that is needed is a screwdriver – cutting costs and saving labor. They are lightweight, easy to handle and flexible enough to bend around corners.

"Alathon" demonstrates unusual resistance to chemical reagents. It is substantially unaffected by concentrated hydrochloric, sulfuric, or hydrofluoric acids at room temperature. While permeable to certain organic acids and to some essential oils, it is not altered chemically or mechanically by these materials. The chemical and physical properties of "Alathon" remain unchanged with age, assuring you of long, trouble-free service.



This expansion joint lined with "Teflon" is designed for service at elevated temperatures and pressures. It is inert to all normally encountered industrial chemicals. *(Manufactured by John L. Dore Co., Houston, Texas.)*

Where operating conditions are toughest in the chemical industry, parts of "Teflon" tetrafluoroethylene resin assure dependable operation. Du Pont "Teflon" is not attacked by any chemicals normally encountered – only alkali metals and fluorine under special conditions affect "Teflon." And, conversely, "Teflon" will not contaminate the products in contact with it. The operating temperature range of "Teflon", coupled with its chemical inertness, provides new opportunities for designers of process equipment.

A typical application is the John L. Dore Expansion Joint lined with "Teflon." This joint is designed for service at elevated temperatures and pressures. It features an "L"-shaped steel sleeve imbedded in the flange to prevent distortion. Bolt pressure is transmitted directly to the "Teflon" extending over the flange face, thus assuring a leak-proof seal against the companion flange. The "Teflon" is the only material touched by line commodities.

It will pay you to investigate the possibilities of using "Teflon" in your own application since no other flexible material can serve you so well over such a wide range of conditions.

NEED MORE INFORMATION?

CLIP THE COUPON for additional data on the properties and applications of these Du Pont engineering materials.

** "Teflon," "Alathon," "Zytel" and "Lucite" are registered trade-marks of E. I. du Pont de Nemours & Co. (Inc.).*

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 2510, Du Pont Building, Wilmington 98, Delaware
In Canada: Du Pont Company of Canada Limited, P.O. Box 660, Montreal, Quebec.

Please send me more information on the Du Pont engineering materials checked: ☐ "Teflon"* tetrafluoroethylene resin; ☐ "Alathon"* polyethylene resin; ☐ "Zytel"* nylon resin; ☐ "Lucite"* acrylic resin. I am interested in evaluating these materials for_____

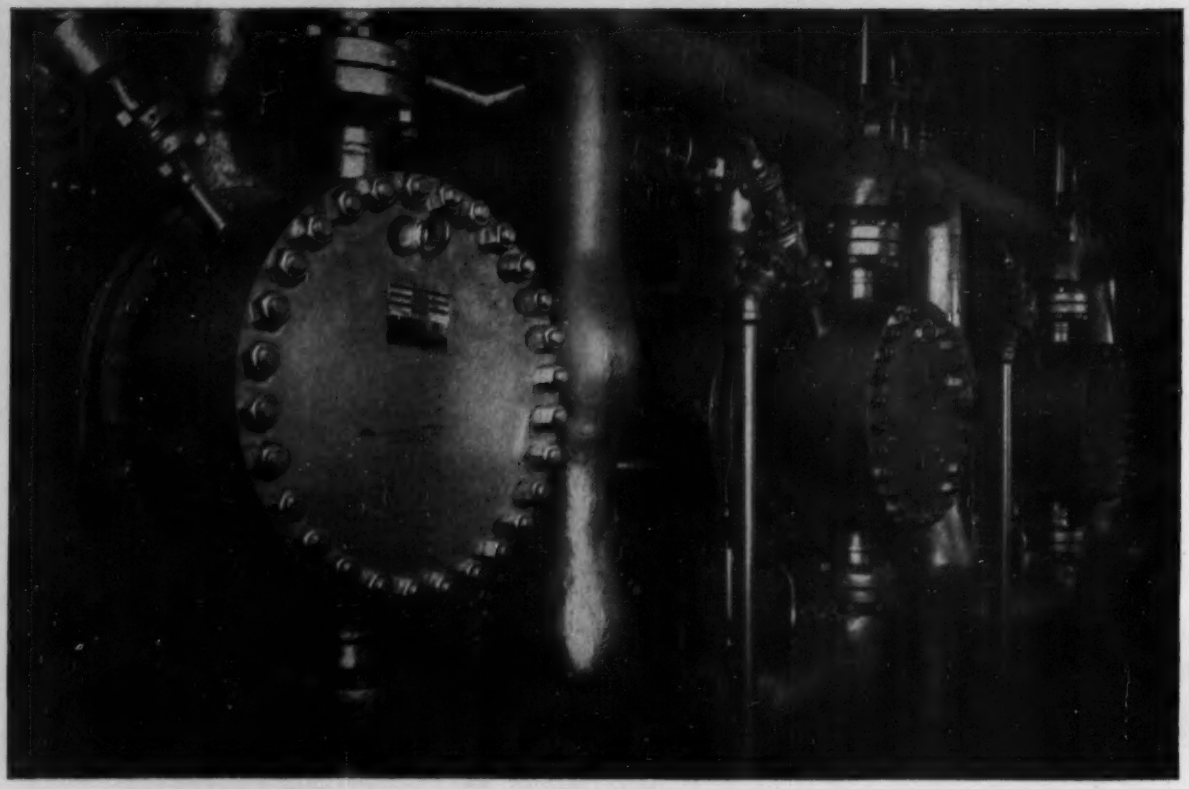
NAME_____

COMPANY_____ POSITION_____

STREET_____

CITY_____ STATE_____

TYPE OF BUSINESS_____



THE ROSS STORY

Special Heat Exchange Equipment for Power Plants

Simply stated, Ross designs and manufactures heat exchangers for virtually all conditions and applications, particularly units of a highly specialized nature, such as high pressure power plant equipment...bleeder heaters and fuel oil heaters, for example.

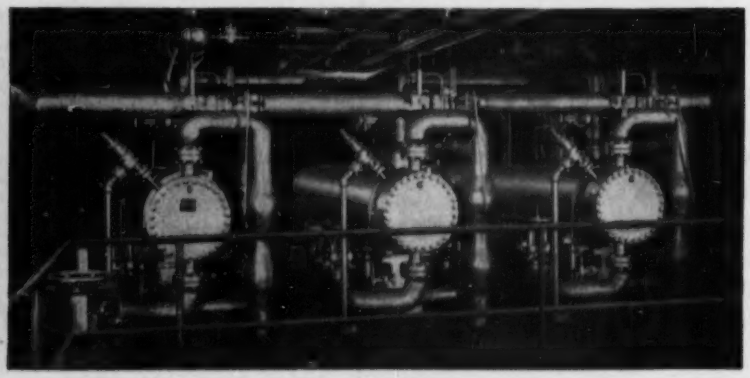
The installation of 6 Ross High Pressure Fuel Oil Heaters (illustrated) at the Pacific Gas and Electric Co.'s Station P Steam Plant in San Francisco is typical. Featuring forged oil channels with integral tube sheets and a double tube sheet arrangement to insure against any possibility of fuel oil contaminating the steam system, these rugged units demonstrate Ross' resourcefulness and experience in dealing with both the average and the specialized power engineering problem.

Your requirements, too, can be met with the same, exacting Ross attention to details. Inquire now. Ross offices are in all principal cities.

For recommendations on specialized heat exchangers, as well as on surface condensers, turbine oil coolers, engine oil and water coolers, compressor inter and after coolers and related power plant equipment, you'll profit by consulting a Ross engineer.

ROSS

ROSS HEAT EXCHANGER DIVISION
of
AMERICAN - Standard
BUFFALO 13, N. Y.
In Canada: American-Standard Products (Canada) Limited



for lower cost control of moderately **Corrosive** fluids

Fig. 2651-A Gate

JENKINS

NICKEL IRON

Valves with Type 316

STAINLESS STEEL

Trim

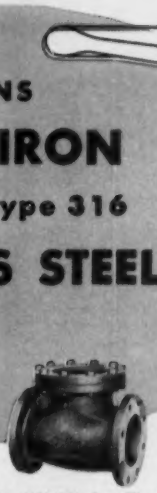
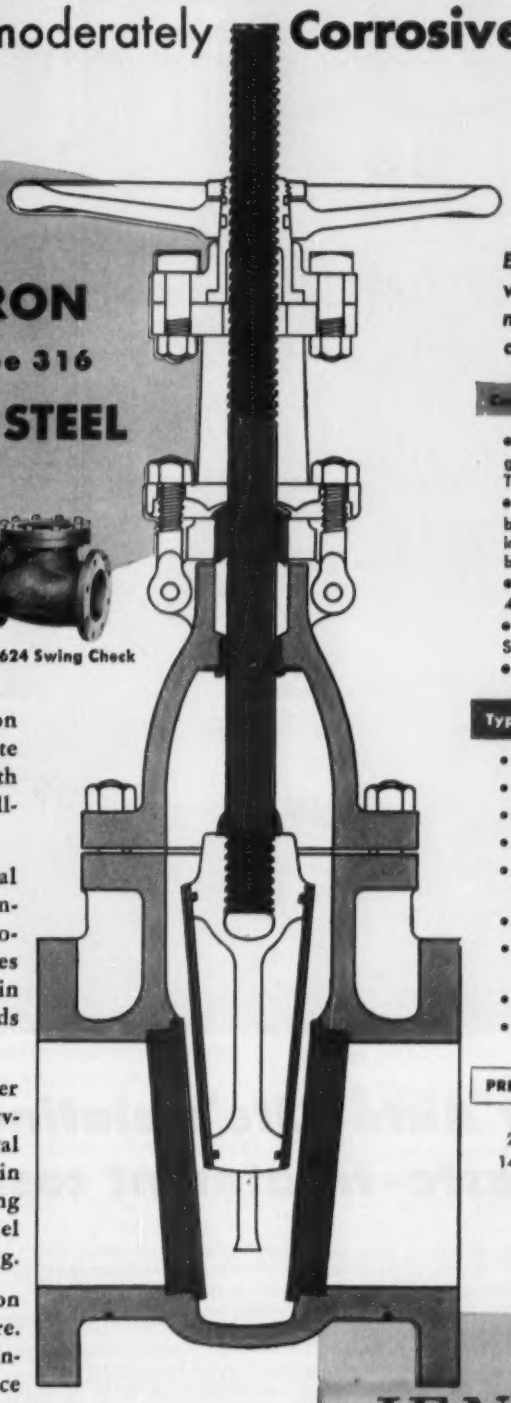


Fig. 2624 Swing Check



Every part in contact with fluid is the right metal to block corrosion and beat wear.

Cast NICKEL IRON

- **BODIES** Heavy duty, dimensioned for greater resistance to wear and abuse. Through port design in Gate Valves.
- **BONNET** Rugged construction, like body. Swing-type gland bolts. Screwed-in back-seating bushing. Deep stuffing box.
- **YOKE** Integral with bonnet in 2″ to 4″ sizes.
- **WEDGE** In 10″ to 24″ sizes, with Stainless Steel Wedge Rings.
- **COVER** In Check Valve.

Type 316 STAINLESS STEEL

- SPINDLE
- GLAND
- BONNET BUSHING
- SPINDLE WING
- WEDGE of I-beam structure in 2″ to 8″ sizes.
- WEDGE PIN
- WEDGE RINGS Rolled into Nickel Iron Wedge in 10″ to 24″ sizes.
- SEAT RINGS
- DISC and HANGER in Check Valve

PRESSURE RATINGS

2″ to 12″—200 lbs. O.W.G.
14″ to 24″—150 lbs. O.W.G.

This combination provides corrosion resistance well above the moderate need in many processing services with an investment well below that for all-stainless steel valves.

Designed primarily for the chemical process industries, they are recommended for control of mildly corrosive liquids with minimum quantities of mineral acids, such as creosote in wood treatment, and many liquids carried in petroleum processing.

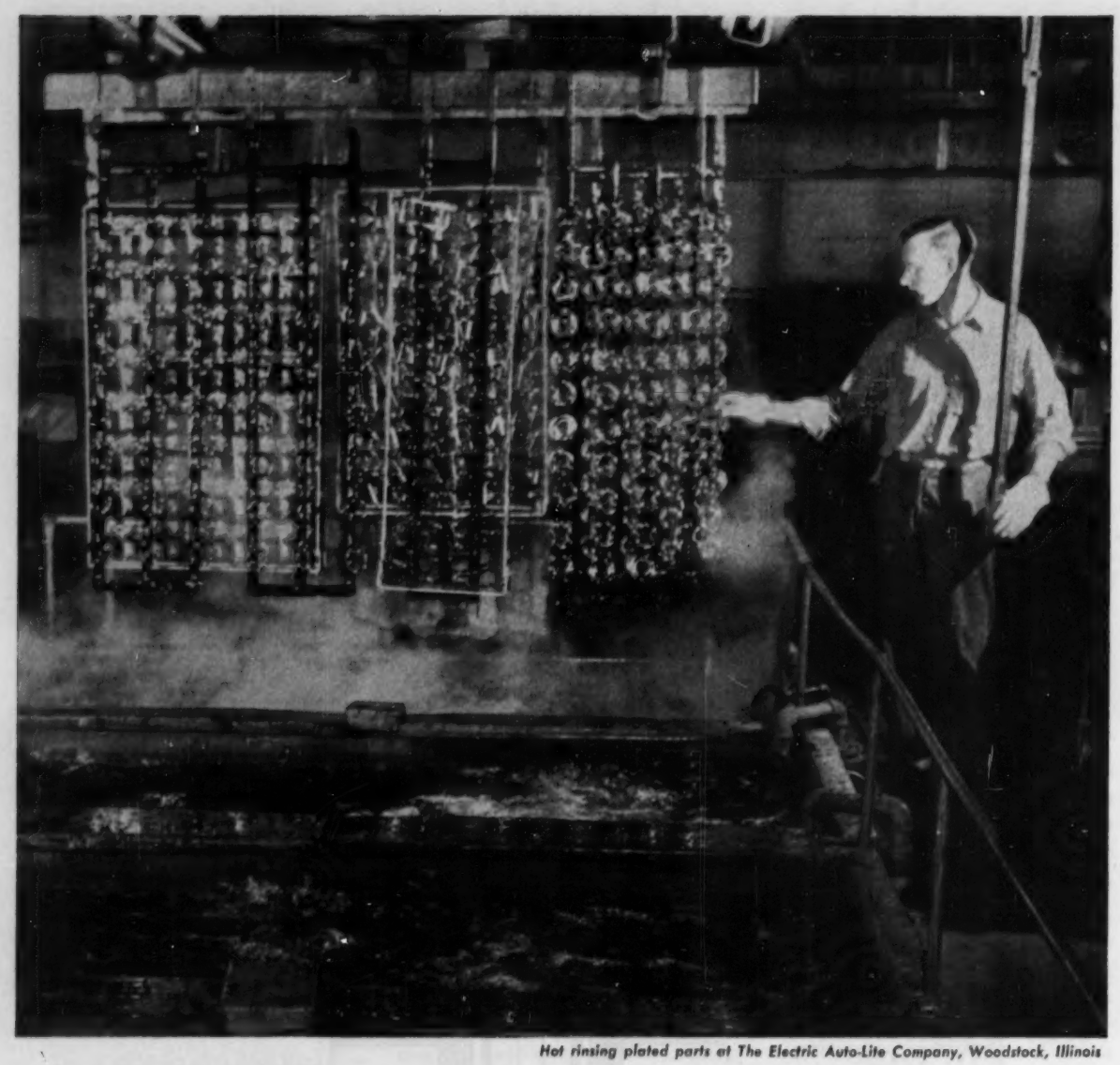
A major use is in pulp and paper processing, particularly in lines serving the digester, and in the chemical recovery cycle. Service records in lines carrying the valve-punishing "black liquor" give Jenkins Nickel Iron Valves top performance rating.

Jenkins *extra value* construction throughout. Get details — compare. See why they stretch your valve investment dollar — with longer service life, lower maintenance cost.

ALSO RECOMMENDED for fluids used in electroplating, photograph finishing, textile bleaching, dyeing and finishing and heat treating of metals.

GET COMPLETE SPECIFICATIONS from your Jenkins Valve Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17. Ask for Bulletin 118.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864



Hot rinsing plated parts at The Electric Auto-Lite Company, Woodstock, Illinois

How Auto-Lite's plating plant cuts waste-treatment costs in half!

Auto-Lite's castings go from the chrome plating baths into a "save rinse" where most of the adhering chrome solution is removed. Then castings get three more cold rinses and a final hot rinse.

When chromic acid concentration builds up to 5% in the "save rinse", the solution passes through a cation exchanger containing Permutit Q for the removal of metallic impurities. After concentration, this purified acid goes right back to renew the plating bath's strength.

Water from the cold rinses contains about 300 ppm of chromic acid. It is recirculated through a cation exchanger containing Permutit Q which takes out metallic impurities. Then it is passed through an anion exchanger containing Permutit S which takes out and holds the chromate ions, producing demineralized water. The chromic acid, absorbed as chromate in the anion exchanger, is recovered by regenerating with caustic soda and passing the regenerant effluent through the cation exchanger (Permutit Q). The recovered acid solution is concentrated by evaporation to the desired concentration for re-run in the plating bath.

Results: Waste-treatment of rinse water is completely eliminated. The demineralized rinse water can be re-used indefinitely to cut water costs. Plating baths last many times longer. Chromic acid consumption is cut 65%. Total waste-disposal treatment costs are cut in half! And they get a cleaner, higher-grade plating job.

In the same way, ion exchange cuts costs in anodizing, bright dipping, pickling, brass etching, copper stripping. It also recovers copper and zinc from rayon wastes, concentrates uranium from complex ores, removes impurities from sugar, drugs, antibiotics.

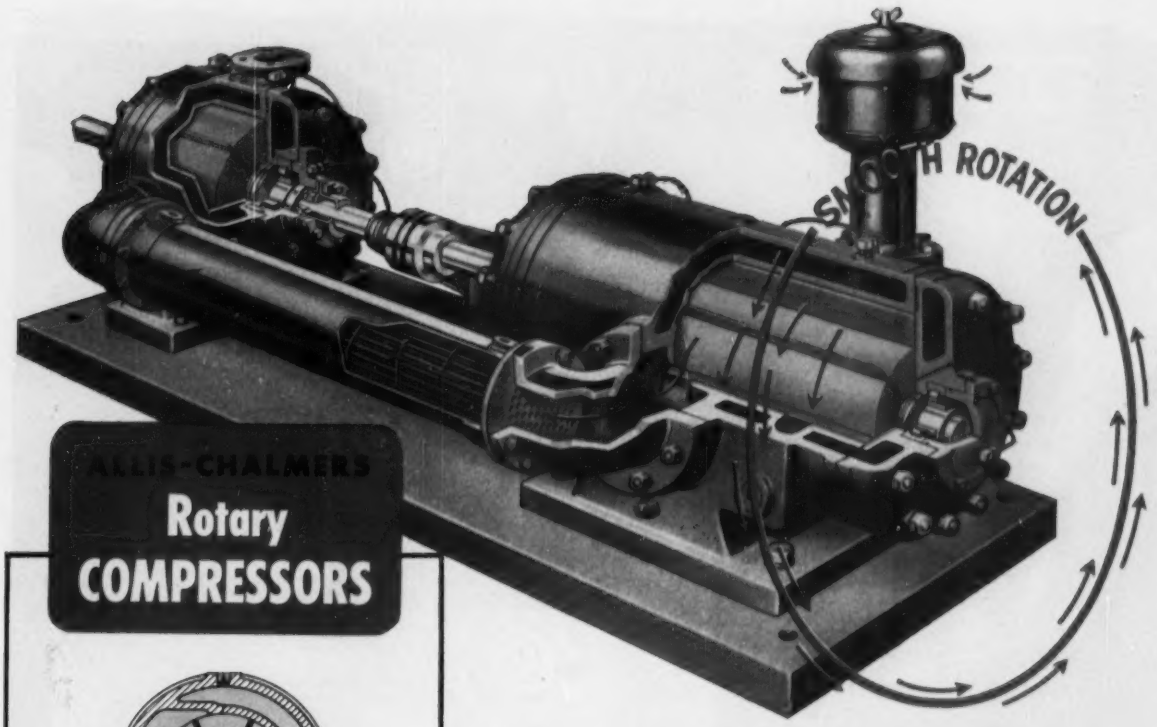
We'll be glad to look into ways ion exchange might improve *your* process. The Permutit Company, Dept. CE-10, 330 West 42nd St., N. Y. 36, N. Y. or The Permutit Co. of Canada, Ltd., Toronto 1, Ontario.

PERMUTIT®

rhymes with "compute it"

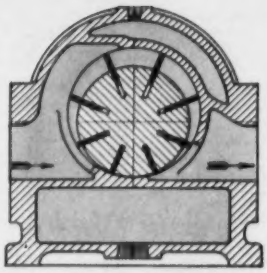
ION EXCHANGE for Water Conditioning

Chemical Processing • Industrial Waste Treatment



ALLIS-CHALMERS

Rotary COMPRESSORS



How Ro-Flo units operate: Centrifugal force moves vanes to outside wall to form air chamber.

Smooth-running Ro-Flo Compressors cut vibration, and provide...

Constant Efficiency

YEAR after year there is no change in the efficiency of a *Ro-Flo* compressor.

Efficiency always remains uniformly high even if parts wear. Here's the reason:

During operation the sliding vanes of the rotor (see cross section above) press against the cylinder wall to form air cells. Even if these vanes wear, the centrifugal force holds them in contact with the cylinder wall so that the air cell never changes and efficiency and air flow remain constant.

Rotary Means Smooth Operation

Smooth rotation cuts vibration ... eliminates need for heavy foundations. Small *Ro-Flo* units can be bolted directly to the floor. Large units need only a simple slab.

Maintenance is low. There is no wear and tear on compressors from shock and vibration ... no pistons and valves.

A Type and Size for Every Need

Single-stage units for pressures to 50 pounds gauge, and volumes from 42 to 3245 cfm. Two-stage units for 250 to 1800 cfm at pressures from 60 to 125 pounds gauge.

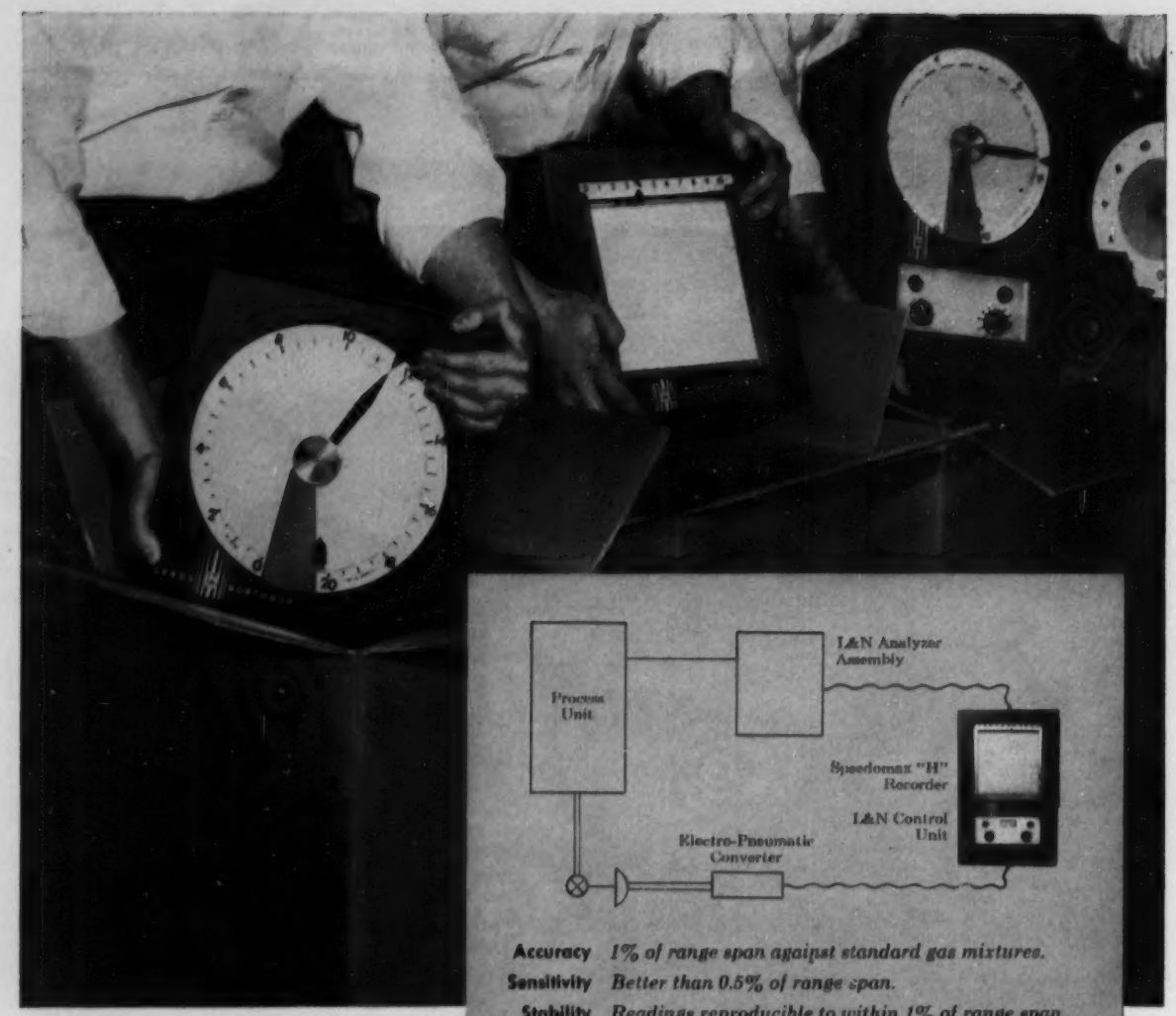
Single and two-stage vacuum pumps for vacuums to 0.3 inch mercury absolute from 22 to 5950 cfm.

GET INFORMATION — Call your nearest A-C office or write for bulletins 16B8244 (2-stage) and 16B8126 (1-stage). Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wis.

Ro-Flo is an Allis-Chalmers trademark.

ALLIS-CHALMERS A-C ALLIS-CHALMERS

A-5134



Accuracy	*1% of range span against standard gas mixtures.*
Sensitivity	*Better than 0.5% of range span.*
Stability	*Readings reproducible to within 1% of range span.*
Response	*About 10 seconds for detection; 50 seconds for 90% of final reading.*

Filling the demand for economical Process-Gas Analysis

. . . is our new family of compact Speedomax® Type H thermal conductivity recorders and controllers. They're teamed with established L&N thermal conductivity cell equipment for an economical new approach to process gas measurement and control.

These Speedomax H instruments couple the most-wanted performance features of their well-known Speedomax G parent with small (11" wide) size, and economies in price. Modern manufacturing methods cut production costs and delivery time without sacrificing the resolution and operating precision for which process men specify Speedomax.

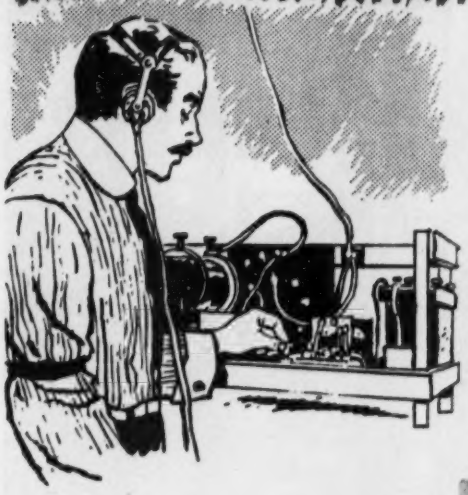
Control through the Speedomax H instruments can be either all-electronic or electro-pneumatic. The 3-action Series 60 Control Unit, used for either form of control, plugs compactly into the Speedomax case. Its replacement parts are also plug-in for service ease. Ranges available include: 0 to 20% CO_2, 0 to 15% SO_2, 0 to 20% SO_2, 95 to 100% H_2 in O_2, 95 to 100% O_2 in H_2, 0 to 100 uncalibrated.

Want details? Write for Folder ND46-91(6) to Leeds & Northrup Company, 4916 Stenton Avenue, Philadelphia 44, Pa.

LEEDS & NORTHRUP
Instruments — Automatic Controls • Furnaces

Jrl. Ad. 46-91(10)

75 years ago and 14 years before the first Practical Wireless was invented



Koven was making individualized chemical equipment

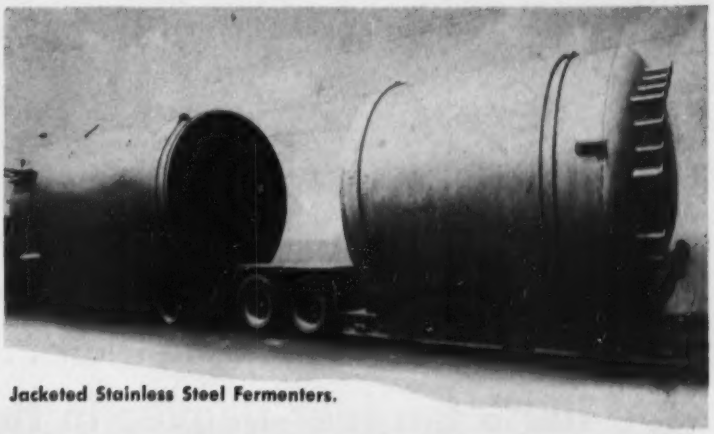
There's no substitute for experience—the time and the skill it takes to manufacture individualized chemical equipment which saves trouble and expense for chemical manufacturers.

For 75 years KOVEN has produced just this kind of equipment—efficient, low-cost equipment fabricated to exact specifications—thereby helping countless manufacturers in their efforts to achieve fast, economical production.

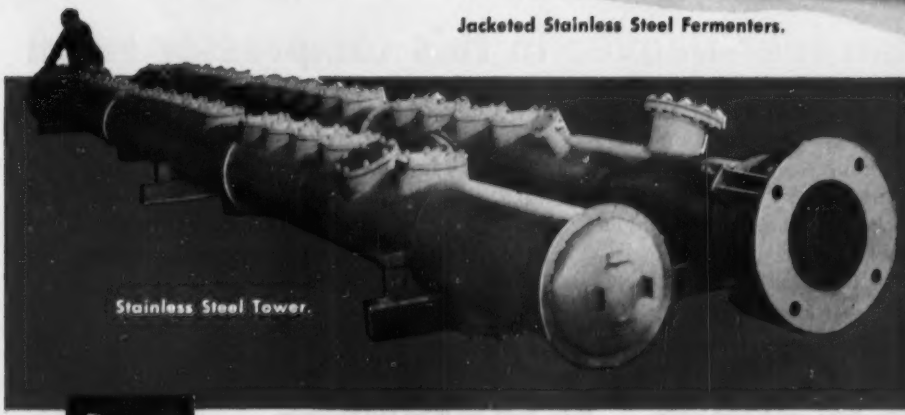
KOVEN asks you to investigate. You can do it by simply sending for Bulletin #550, and either calling or writing for a consultation with a trained representative. Do it today. There's no obligation.

X-RAY INSPECTION FOR QUALITY CONTROL

KOVEN equipment in all metals and alloys includes: High pressure vessels built to A.S.M.E., A.P.I. Codes; extractors; mixers; stills; kettles; tanks; stacks; breechings; hot transfer lines; light and heavy fabricated piping and plate exhaust ducts. Shop and field erected storage tanks to 2 million gallons. High vacuum testing on liquid oxygen storage tanks.



Jacketed Stainless Steel Fermenters.



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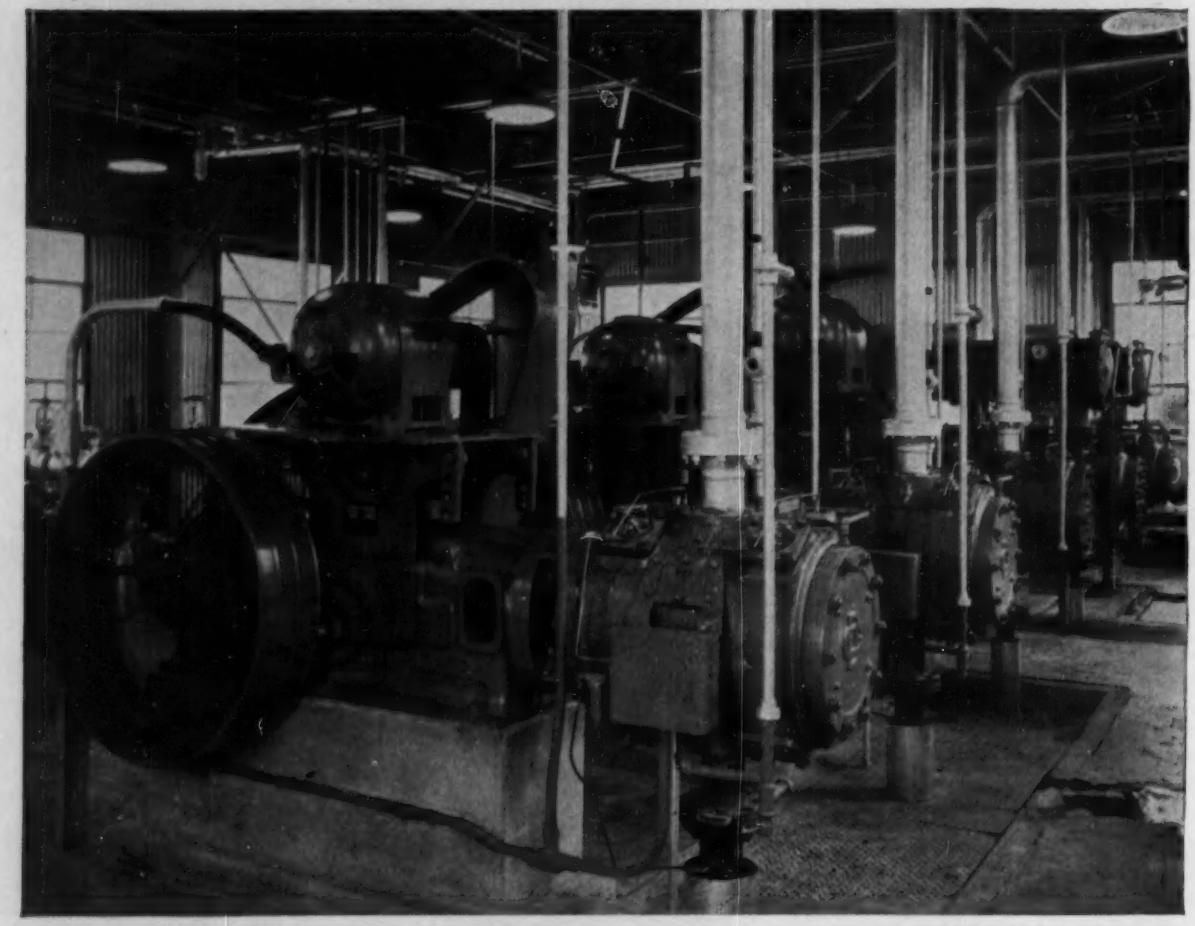

A roomful of compressors supplying instrument air . . . plant air . . . starting air . . .

it's 100% Gardner-Denver in this compressor room

Instrument air . . . furnished pure, clean and oil-free by two Gardner-Denver 10 x 9 CRX Carbon Piston Compressors.

Plant air for general use . . . supplied by a single Gardner-Denver 10 x 11 RX Single-Stage Compressor.

High-pressure air for starting diesel engines . . . supplied by two Gardner-Denver 9 & 4½ x 9 RXT Tandem Cylinder Compressors.

For any volume . . . any pressure . . . any use . . . your Gardner-Denver Compressor Specialist can fill your needs from Gardner-Denver's wide range of compressor types and sizes. Write for bulletins.

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THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

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vented Explosion-Proof Fixtures are BETTER!

- **"FLAME-TIGHT" CONTACT CHAMBER**
  Exclusive safety chamber prevents explosions even when fixture is serviced with current on! APPLETON *Series AA-51 Vented Explosion-proof Fixtures* offer the positive protection required for hazardous areas.
- **"FULL-CIRCLE" VENTING**
  Porous metal interior and specially designed hood dissipate heat evenly and safely . . . keep fixture temperature down, provide longer lamp life.
- **"INTERCHANGEABLE" UNILET BODY**
  Standardized diameters at top of Dome Unit Assembly permit interchange with AA-51 fixtures of varying wattages.

plus conversion to different wattages or relamping in just *58 SECONDS!* . . . with no loss of man-hours or lengthy shut-downs. Send for complete information today!

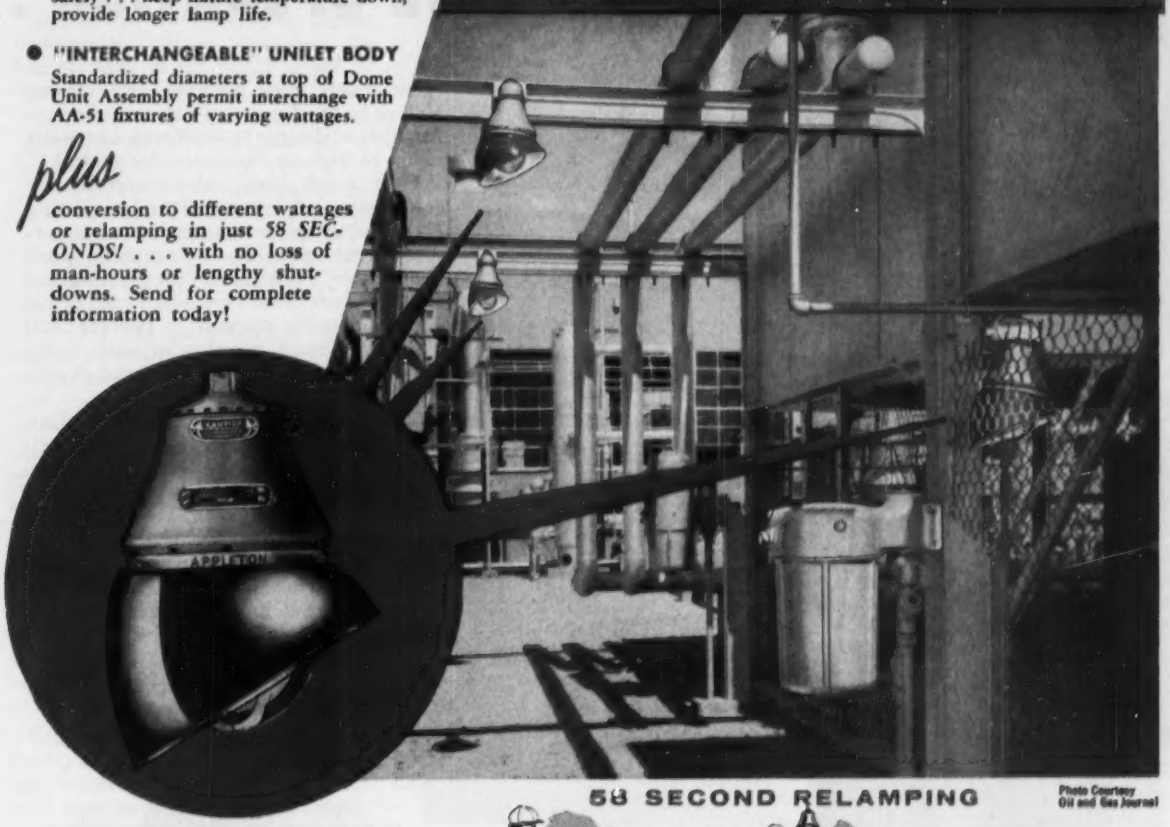
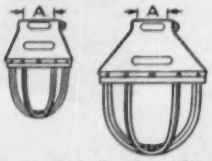


Photo Courtesy Oil and Gas Journal

APPLETON INTERCHANGEABLE UNILET BODY FEATURE



Note how identical diameters "A" on Dome Assemblies allow quick interchange of fixtures with different wattages.

58 SECOND RELAMPING

Series AA-51 stand-by units are ready at an instant's notice for relamping . . . with handles attached in advance.

Only a screw driver is needed to change units . . . and ONLY 58 SECONDS to climb ladder, change unit and descend!

Cleaning fixtures, changing burned out lamps can safely be attended to at bench . . . preventing costly shut-downs.

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Rely on **APPLETON** *. . . the standard for better wiring*

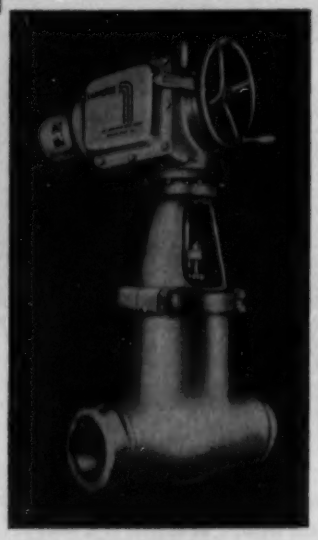
Ever figure what it costs **NOT** to use

LimiTorque® *Automatic* VALVE OPERATION?

How much does opening and closing Valves *by hand* cost you—in man-hours—in physical danger to workmen who must climb to high or dangerous locations?

How much time, labor, and money could be saved in your plant by opening and closing valves *automatically*—at correct operating speeds—by the mere "push of a button"? With LimiTorque, one finger does the work of many hands. LimiTorque control permits one man to operate, and know the exact position of each valve from a central, conveniently located control panel.

LimiTorque protects valve seats, discs and stems from damage, by automatically shutting-off power source, should an obstruction interfere with valve closing. Valves operated by LimiTorque are always seated tightly, because the seating thrust of valve disc is accurately maintained in each closing-cycle, due to the patented torque limiting mechanism.



LimiTorque is, by far, the most widely used valve operator in the World... Send for complete new Catalog L-550, on your Business Letterhead.

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"Used many makes of turbines... PREFERS COPPUS"

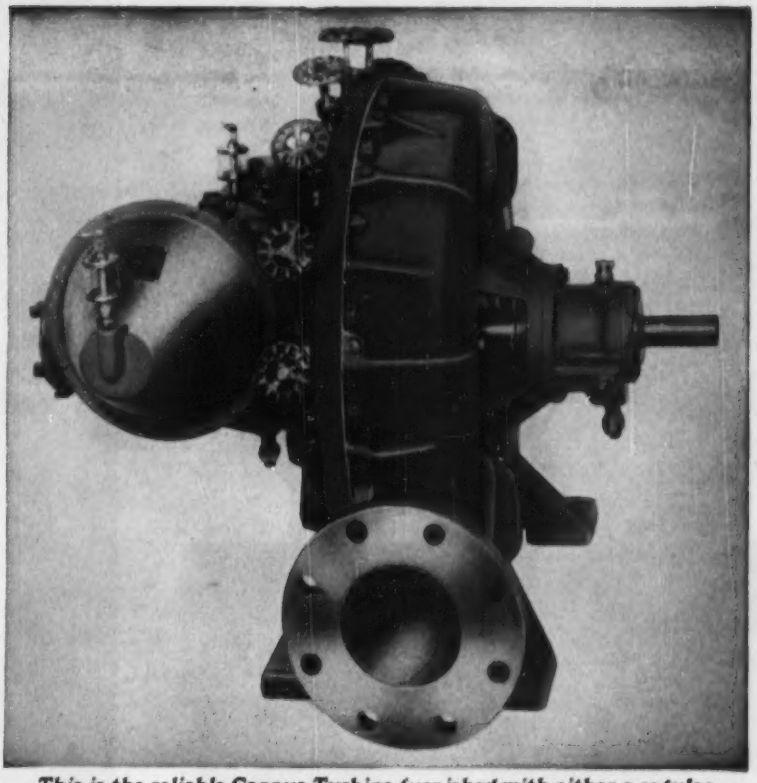
If you want to know about turbine performance, ask an *operator*. He *knows*. And, in the words of one of them:

> "I have had occasion in the past to operate many makes of turbines. The plant in which I am now employed is almost entirely Coppus equipped on our auxiliary equipment. I find your turbines most satisfactory and would like to congratulate you on your design."

Whether you use a Coppus with a regular wheel or wide bucket "L" type you get these *proven* features:

- Turbines rated close to your hp requirements from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed safety trip supplementing constant speed governor.
- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.
- Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes, *make turbine dollars go farther*. Send for Bulletin 135 on Coppus Turbine.

COPPUS ENGINEERING CORPORATION
230 Park Avenue, Worcester 2, Mass.
Sales offices in THOMAS' REGISTER



This is the reliable Coppus Turbine furnished with either a regular wheel or wide bucket "L" type wheel.

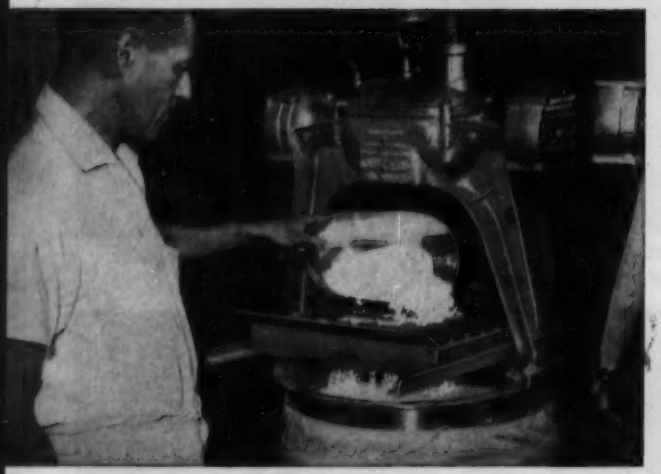
This wide bucket "L" type wheel is a new development for use where low water rate is essential

This is the regular wheel used on Coppus Turbines which have been so highly satisfactory throughout industry.

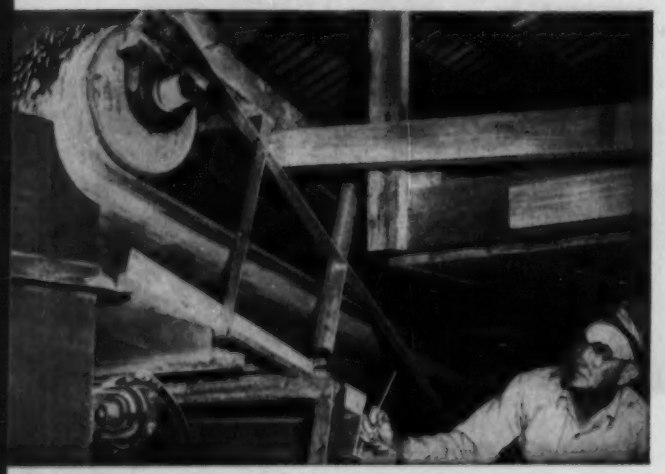
COPPUS "BLUE RIBBON" TURBINES

UPSIDE-DOWN ROLLER DERBY? Not at all. The young lady is demonstrating the tremendous power of an Eriez Magnet. Seventeen times stronger than old magneto magnets, the power of new Eriez Magnets has given ideas about getting rid of dangerous tramp iron . . . which causes fires, machinery damage and product contamination . . . to every form of industry. *All Eriez Magnets are non-electric, self-contained. They operate without any wires or attachments. Best of all their magnetic power lasts a lifetime. The first cost is the last.*

MAGNETIC IDEAS FROM ERIEZ



GRATE MAGNET DOES GREAT JOB ON RIDDLE. Burroughs Wellcome & Co. (U.S.A.) Inc., Tuckahoe, N. Y., producers of drugs and chemicals, recently installed an Eriez Permanent Grate Magnet over a riddle used to sift powders. Although there previously had been occasional traces of contamination in the powder due to minute ferrous particles (in some cases invisible to the human eye) the finished product is now completely free of metal contamination. Even microscopic particles of metal have been removed from the powder by the powerful action of the Eriez Grate Magnet.



New! ERIEZ HI-VI ELECTRO-PERMANENT MAGNETIC VIBRATORY EQUIPMENT

ERIEZ HI-VI VIBRATORY EQUIPMENT

No other vibratory equipment like this! Eriez magnetic "know-how" brings you the first complete line of Electro-PERMANENT Magnetic Unit (Bin) Vibrators and Feeders operating at 3600 CPM directly off an AC line. Just plug or wire them in . . .

NO RECTIFIER NEEDED!

HI-VI units move materials faster . . . increase production . . . give broader operating scope with less power consumption. They give longer, trouble-free service with less maintenance and operating costs. They are compact, easily installed, lightweight, never need realigning and there are no sliding or rotating parts to wear.

ERIEZ HI-VI UNIT (BIN) VIBRATORS keep bulk materials flowing freely

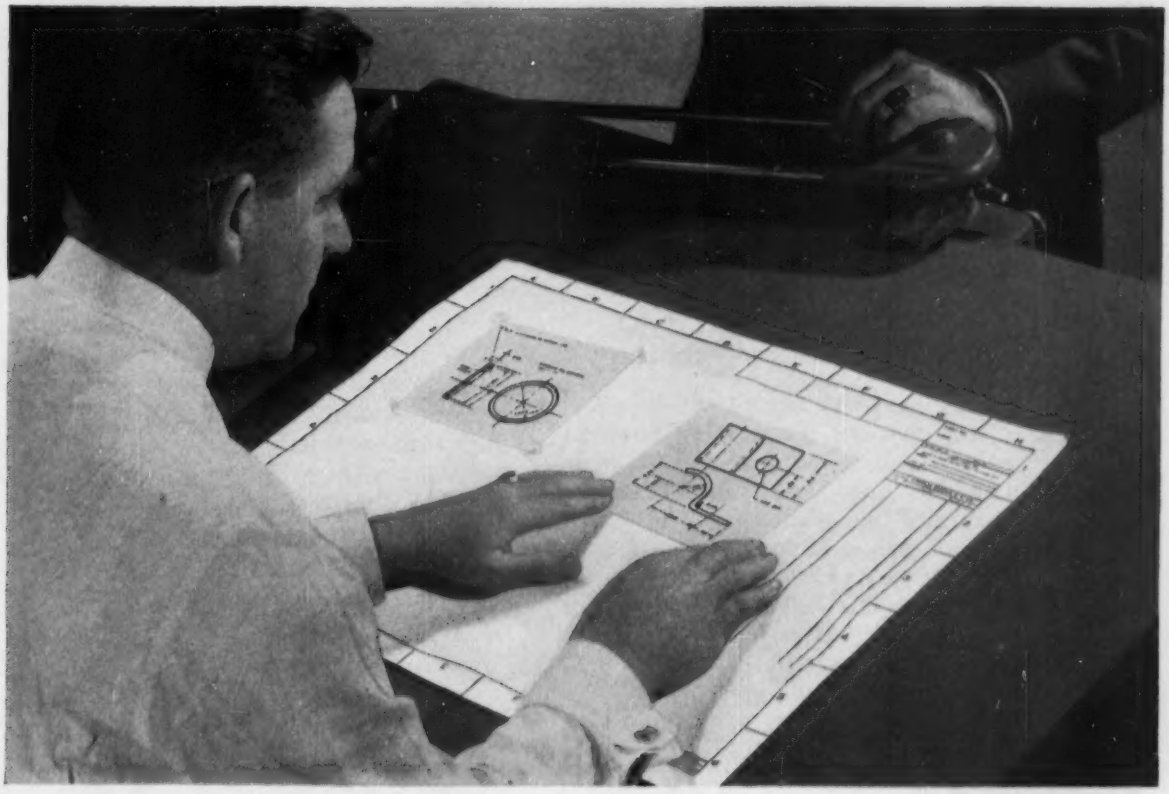
ERIEZ HI-VI VIBRATORY FEEDERS for accurate, controlled feed

WRITE FOR COMPLETE INFORMATION

GUARDING EQUIPMENT AGAINST TRAMP IRON. Cal-Compack Foods, Inc., Santa Ana, Calif., processor of dehydrated and ground peppers, protects its valuable 100 hp hammermill . . . and even more valuable reputation for product purity . . . with an installation of an Eriez Magnetic Pulley on its inspection belt. Peppers brought to the plant directly from the field naturally pick up stray iron. The Eriez Magnet cleans out this dangerous tramp iron from the peppers at the rate of about 5 lbs. per day!

•

Eriez' free booklet "Magnetic Ideas" can help you. Send for it without obligation, ERIEZ MANUFACTURING COMPANY, 74K Magnet drive, Erie, Pa. OR on your specific request Eriez factory-trained field men backed by Eriez' laboratory and engineering know-how, will be happy to study your particular problem, make a plant survey and offer helpful "Magnetic Ideas."



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New booklet is jam-packed with valuable tips on saving drafting time, protecting drawings, getting better prints.

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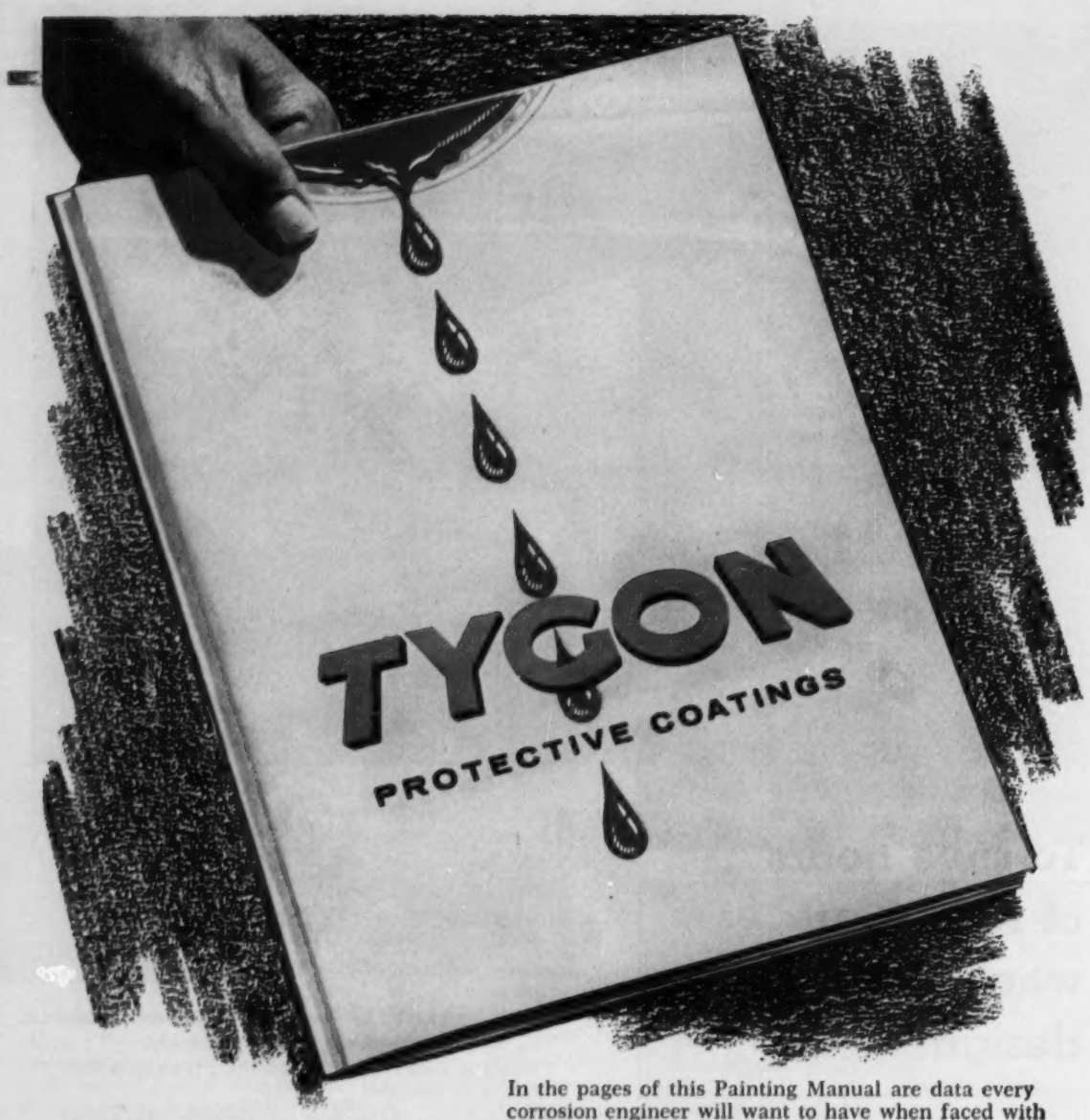


Recommended reading for CORROSION ENGINEERS

In the pages of this Painting Manual are data every corrosion engineer will want to have when faced with problems involving protective coatings.

How to save time and money in surface preparation; how to secure good adhesion with vinyl-based top coatings; how many top coats to provide effective protection against a given corrosive; common spraying problems and how to remedy them.

Primarily, of course, the Manual deals with the Tygon series of protective coatings—the protective coatings developed specifically to meet severe corrosion problems.

Detailed data on the characteristics of the various Tygon coatings; where and how to use them; complete tables of chemicals to which the coatings are resistant; these and other helpful data are yours in this free manual.

Write for it today.
Ask for the
Tygon Painting Manual.

343E

Plastics & Synthetics Division

U. S. STONEWARE

AKRON 9, OHIO

OCTOBER 1956

·Chementator

H. T. SHARP

√ **Lummus has developed a hot water process for extracting oil from tar sands deposits of Alberta, Can. Several Western Canada companies are now considering a $100-million development program for the sand deposits.**

√ **Off-again, on-again merger of Catalin and Reichhold is off for good. Reichhold pulled out just as Catalin prepared to send proxies to shareholders. Reichhold's reason: Catalin's plans for raising more money were inadequate.**

√ **USI Div. of National Distillers will soon announce a new titanium plant. Site will be Ashtabula, process will be sodium reduction.**

√ **Commercial production of zirconium by electrolysis of the chloride is in the offing. Method was developed in Japan by Nagoya Research Institute.**

New process boosts Ta-Cb yields.

A new liquid-liquid extraction process for separating high-purity tantalum and columbium salts is now being developed by the Bureau of Mines at its Albany, Ore., station.

Now in a bench-scale unit, operating variables haven't been fully investigated, so the bureau can't compare the new method with those now used. But while reagent costs appear higher, the method is expected to save time and processing steps.

After dissolving the tantalum-columbium concentrate in a mixed hydrofluoric-sulfuric acid solution (13-14 normal), the bureau extracts the Ta and Cb with methyl isobutyl ketone. The first separation consistently recovers 95% of the Ta–Cb, and the organic phase contains only 0.1% impurities by weight. Additional extractions can increase the recovery to 99% if desired.

Columbium is stripped from the organic phase by a weaker hydrofluoric-sulfuric acid solution (3-4 normal). This recovers 90-95% of the columbium. Purity is 99.9%.

A still weaker acid strip removes the remaining 5-10% of the columbium and about 5-10% of the tantalum, leaving behind 90-95% of the tantalum in the MIBK. Tantalum purity, too, is 99.9%.

Two firms build Ta-Cb plants

While keeping one eye on the Bureau of Mines' work on its new tantalum-columbium process (see above), industry is moving ahead with its own plans for boosting output of Ta-Cb salts and metal.

Currently, tantalum is widely used in electrical capacitors and in corrosion-resistant equipment. Columbium goes into special alloys for high-temperature uses. Markets for both metals are expected to grow with the use of gas turbine engines and the increase in the number of nuclear reactors.

• Fansteel Metallurgical Corp., North Chicago, Ill., will use an older liquid-liquid extrac-

tion process developed by the Bureau of Mines in a just-announced $6.5 million plant to be built at Muskogee, Okla. This process uses hydrochloric acid to extract tantalum fluorides from a mixture of aliphatic and aromatic ketones. Fansteel now has the process in the pilot-plant stage (*Chementator*, May 1956, p. 104). The company will make tantalum and columbium metal as well as a variety of salts.

• Kawecki Chemical, Boyertown, Pa., started commercial production of tantalum salts and metal in mid-August. A columbium plant is due on stream in January. Kawecki uses an original process that it has pilot-planted for over two years. While patents are pending, Kawecki isn't ready to tell how it goes from ore to metal.

• Electro Metallurgical, a division of Union Carbide and Carbon that now makes a ferro-tantalum-columbium alloy, reports that it has accelerated development work on tantalum.

• National Research has also developed a separation process and is considering commercial production of both metals.

• Horizons Titanium claims to have made very high purity tantalum metal by its own electrolytic process, but it has no plans for commercial production in the near future.

Set to mass-produce nuclear reactors

Aerojet-General Nucleonics, San Ramon, Calif., says it's now ready to mass produce small, low-power nuclear reactors for training and experimental uses.

The reactor resembles a liquid homogeneous reactor (*Chem. Eng.*, Sept. 1956, p. 122), but the core is actually a solid homogeneous mass. The radiation-stabilized polyethylene moderator contains about 600 grams of uranium enriched to 20% with U-235.

AGN feels that the unit's comparatively low cost (less than $100,000 for the reactor, training in using it and help in getting an AEC license) will lead to its widespread use by schools, hospitals, research labs and industry.

Another interesting reactor concept is now being developed by Nuclear Development Corp., White Plains, N. Y., in partnership with AEC and Chugach Electric Assn., Anchorage, Alaska. A deuterium-moderated, sodium-cooled unit, it embodies one of the oldest reactor concepts, operates on low-enriched fuel, features high fuel burnup, low-pressure operation and inherent safety characteristics.

First proposed in 1940, the deuterium-sodium concept has been sidetracked many times by limited quanities of heavy water and lack of know-how in managing deuterium-sodium systems. A drop in the price of heavy water from several hundred dollars per pound to $28/lb. and progress in metallurgy have moved the concept from the shelf to the design boards.

NDA will design a 10,000-kw. capacity reactor to be located at Anchorage. Power from the reactor is expected to sell in the 10-12 mill bracket, competitive with hydroelectric power and well under that from coal-fired plants.

Filling need for purer aromatics

Chemical industry demands for higher quality benzene, toluene and xylenes—or lower prices—have caught the ear of at least two steel firms. Out to recapture some of their slipping market from petroleum producers of BTX, two big coke-oven operators, Jones & Laughlin and U. S. Steel, will try petroleum refining techniques to get the sulfur out of their product.

Essentially, both will hydrogenate the light oils to convert sulfur compounds to hydrogen sulfide and to hydrogenate unsaturates. The H_2S is then driven off and the light oils sent to an extractor where a glycol solvent removes the BTX. Distillation recovers the BTX.

J&L will use Esso Research and Engineering's Hydrofining process for sulfur removal and Universal Oil Products' Udex process for extraction in a $2 million installation being built at its Aliquippa, Pa., works. Badger Manufacturing, which helped adapt Hydrofining for this application, is prime contractor. Due to be completed early next year, the Hydrofiner will have a capacity of 55,000 gal./stream day and Udex unit will be rated at 56,500 gal./stream day.

Hydrofining uses pure hydrogen at 400-800 F., 50-800 psig. (depending on feed composition) to treat the light oils.

U. S. Steel will use the German-developed Scholven Chemie process (*Chem. Eng.*, Sept. 1952, p. 220) to process about 150,000 gal. of light oil per day in a multi-million dollar plant at Clairton, Pa.—site of the world's largest coke plant operation. Koppers Co., which has the U. S. rights to the process (*Chementator*, Feb. 1956, p. 106), will handle construction. Building will start this fall, be completed late next year.

(Continued on page 108)

Actual laboratory pre-tests prove you can...

Blend liquids into dry materials fast, in one operation... without lumps

Getting perfect dispersions of liquids into dry materials without lumping has almost always entailed extra steps for pulverizing, mulling or screening, etc.

But P-K's new *Liquid-Feed** Twin Shell Blender eliminates those extra, costly operations. Now, in a one batch operation, you can achieve complete dispersion of liquids in a matter of minutes. Blender is charged through large dust-tight openings that allow easy access to shell interior for cleaning. Complete Liquid-Feed assembly is quickly removed by means of a spring loaded mechanism.

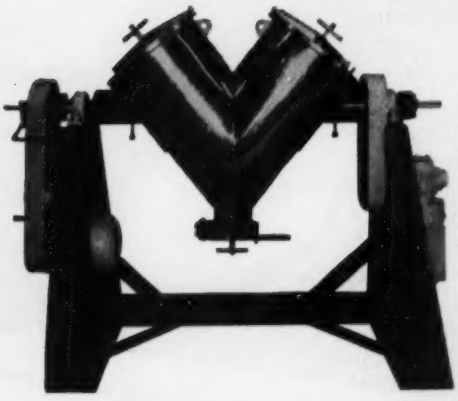
The Liquid-Feed blender is simple in concept. Liquid flows from a feeder tube within the bar onto a revolving distributing disc. Centrifugal force flings a fine spray outward. Dry materials tumbling in the Twin Shell receive liquid in controlled amounts at all times. The wire cage, spinning at high speed, prevents the formation of lumps before or after liquid is introduced.

Results? More perfect blends, in a fraction of time previously required. Want proof? P-K's Process Division maintains a complete lab to assure accurate, predetermined performance to meet your liquid-feed blending requirements. P-K will conduct, without obligation, laboratory test-blends with your materials.

Experimental testing will provide operational procedure and scale-up data. All test reports are held in strict confidence when desired, and, whenever convenient, testing may be supervised or witnessed by your personnel. P-K will submit complete factual test results, including samples of test-blends. Write direct to our Research Department.

The Patterson-Kelley Co., Inc.,
200 Hanson Street, East Stroudsburg, Penna.

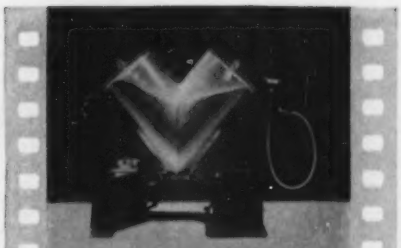
*patented and patents pending



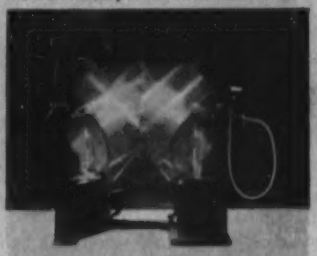
This production model is in stainless steel. Standard liquid-feed twin shell blenders are available in most commercial metals. Sizes range from 3 to 50 cu. ft. working capacity.

Patterson Kelley
Chemical and Process Division

Twin Shell Blenders • Autoclaves • Pilot Plants • Heat Exchangers
Ribbon and Double Cone Blenders • Lever Lock Doors



8 qt. blender is loaded for test with dissimilar materials, one lumpy and light, the other heavy and fine in texture.



Complete uniformity is obtained in a few minutes by dry blending. Lumps are broken up by fast-spinning intensifier bar's wire "cage" assembly.

Liquids are then introduced into the dry blend during rotation by gravity-feed. Distributing disc disperses liquid evenly. Wire cage prevents clumping.

Average blending time is approximately 15 minutes to obtain perfect liquid-feed mix. One step operation eliminates pulverizing, mulling and screening.

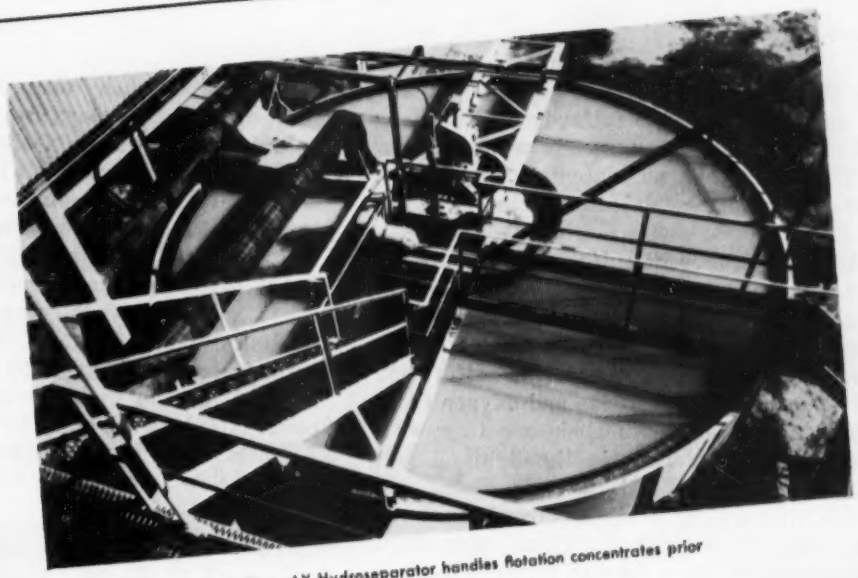
Discharging is easy. Stainless steel liquid-feed assembly ejects instantly, rinses in seconds. Seconds more to wipe clean the smooth, easy-to-get-at interior.

Look What's Happened to Classification...

Wet classification—important unit operation throughout the process industries—demands special equipment and a wide range of designs. Typical of this trend to specialization is the new, ultra-modern phosphate rock washing plant of Armour Fertilizer Works near Bartow, Florida. No less than nineteen individual Dorr "Classifiers" of five radically different designs are being used for size separation.

1 A Dorr Classifier, upper left, makes a 65 mesh separation with rake product capacity of 240 long tons per hour splitting to two 16½ pocket Dorrco Jet Sizers for further classification ahead of screens.

2 Combined overflow from Classifier and Sizers is treated in this 50' dia. Dorr Type H-1 Hydroseparator.



4 High capacity Dorr Type AX Hydroseparator handles flotation concentrates prior to further treatment.

3 Desliming at 150 mesh is accomplished in fourteen 24" dia. DorrClone Separators equipped with Vactrol control devices. Units respond automatically to changes in feed . . . produce uniform underflow at 70-75% solids.

Dorr-Oliver is the only manufacturer of a complete line of wet classification equipment. When you call on Dorr-Oliver you can be sure you'll get an unbiased recommendation . . . the *right* equipment to solve your particular classification problem.

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USS will also install a Udex unit to extract the aromatics from the sulfur-free light oils.

Both USS and J&L expect to wind up with BTX whose thiophene content is less than 1 ppm. and whose solidification point is about 5.4 C.

A slightly different sulfur-removal process was developed in Germany by Lurgi and is now being offered by Blaw-Knox. This one uses the high (45-55%) hydrogen content of coke-oven gas to hydrogenate the sulfur, but first it removes nitric oxide and oxygen from the gas. This prevents their reacting with gum-forming materials in the light oil and fouling the catalyst bed.

B-K cites a Lurgi plant in Nuremberg that's been running two years with no increase in the system pressure drop as evidence for this freedom from fouling.

You can bet that these new plant and process announcements mark only the beginning of the swing from the outmoded acid wash purification method now widely used. Other steel firms are known to be considering hydrodesulfurization.

Chemical firms bid for uranium plant

October 1, 1956. That's the date on which the Atomic Energy Commission gets to see how well the chemical industry responds to one of its "real needs." The need involves plant capacity for 5,000 tons yr. of uranium salts. Roughly a $50 million program, these facilities have to be on stream by April 1959.

Industry has a free hand in picking a way to supply this capacity. Whether it wants to build one large plant or several small ones; whether it wants to mine the ore, buy it or buy concentrate; whether it wants to handle the venture on its own or team up with other firms are decisions to be made by the individual company.

AEC has held three meetings for interested firms to help them prepare their proposals. The commission also offers to train the company's technical personnel in present feed material facilities. But once the plant or plants are built and running AEC will bow out. It will have no management control over the facility.

This type of arrangement appeals to all three present operators of AEC feed materials plants (Mallinckrodt, National Lead and Union Carbide Nuclear), and each is expected to offer a proposal for the new contract.

Mallinckrodt has teamed with Climax Molybdenum to prepare its proposal. Union Carbide Nuclear and Catalytic Construction have also joined forces. It's thought that National Lead plans to join with Allied's General Chemical Div. to make a proposal.

Others who've announced plans include Kennecott Copper and Koppers, a team that says it's studied 27 different ways of making the salts, and Vitro Corp. Vitro teamed up with several other firms to study the situation, but it will probably make a solo proposal. Also believed ready to make a proposal: Atlantic Refining, Grace Chemical, the Texas Co. and New Jersey Zinc.

Octane race features pumps, petitions

The oil refiners' 20-year-old race to bigger and better octane numbers has erupted in a spurt of activity, some of it with only a remote tie to the service station pump.

Fight of independent refiners to block the sale of Universal Oil Products by Guaranty Trust Co., New York, trustee for the American Chemical Society's Petroleum Research Fund (which will get profits from the sale), is one such aspect. Independents fear UOP will pass into control of one of the "majors."

Two associations of independents and a number of individual firms have protested to the Justice Dept. that the proposed sale would lessen competition and tend to create a monopoly in the petroleum industry. Independents say they need UOP's research, processes and engineering help to keep pace with the majors.

One major, Sinclair, has decided to run the other way in this octane derby. It's just- announced "X-Chemical" additive doesn't boost the octane number of the gasoline, it lowers the octane requirement of the motor. Sinclair says this approach also slows engine deposit buildup and stops pre-ignition knock and spark plug fouling—things that octane boosts and present additives don't do. Sinclair declines to identify X-Chemical, since patents are now pending. Observers bet it's an alkyl phosphate.

Three other majors pushed octane numbers up to 100 in the past few weeks and industry observers say that oil men will spend $1.5-2 billion over the next five years for the equipment to make these high octane fuels.

Sun Oil first stepped up the pace early last

(Continued on page 110)

When you need an economical, dry source of SO_2

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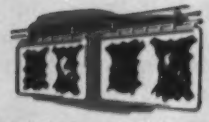

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summer when it put a new pump into its Orlando, Fla., stations. Attentants have only to flick a dial to concoct any of five blends, ranging from about 95 to over 100 octane.

Within weeks Standard Oil (N. J.) started selling a new grade rated at about 100 octane. This was a result of Standard's new fixed-bed reforming technique, Powerforming (*Chementator*, April 1956, p. 108).

By the summer's end, Shell had added a shot of aromatics, mainly benzene, xylene and toluene, to the tricresyl phosphate (TCP) in its premium blend in an effort to boost the octane rating. And Cities Service added an "aviation type fuel" of over 100.

At least three other refiners are now prepared to jump in with more powerful blends if they see sales slipping away from them. At the same time, at least one refinery has dropped out of the race. Wilcox Oil reports that it's shutting down its 5,500 bpd. Bristow, Okla., refinery because it can't compete. The firm has decided to buy refined products from D-X Sunray.

Results of combustion studies told

After a blue-ribbon panel of experts from seven countries had outlined future problems in combustion research, the Sixth International Symposium on Combustion settled down to discuss a week-long series of reports on what's being done now to pave the way toward solving these posers. Though the symposium (held at Yale University, Aug. 19-24) revealed progress on a broad front, by week's end it was clear that there's still much to be done.

Chemical industry interest focused on papers on chemical synthesis via combustion.

Researchers from London's Imperial College told of a process for making hydrogen peroxide by partial combustion of aliphatic alcohols. They report good yields of H_2O_2 from partially oxidizing ethyl alcohol at about 700 F. and immediately condensing the reaction products in liquid nitrogen at —320 F. The peroxide is said to be readily separated from excess alcohol and co-product acetaldehyde.

Reaction Motors, Denville, N. J., reports using a rocket motor to produce 40 tons of nitric oxide per day by direct fixation of atmospheric nitrogen at 5,300-5,700 F. and 315 psia.

Total flow rate of air and ethane reactants is 0.3 lb./sec. After a reactor residence time of 0.0085 sec. (unusually long for a rocket motor), gases pass through a nozzle and cool almost instantly to 2,240 F. by adiabatic expansion. Effluent stream contains 2-2.7% nitric oxide.

Researchers at McGill University, Can., told the symposium that they recover 3.5-4% nitric acid in similar experiments using a higher oxygen concentration. Both RM and McGill say that the cost of separating NO from other reaction products is the biggest obstacle to commercial use of the process. Indicated costs of $30/ton for 100% nitric acid are reported by McGill. RM says that it's using the method to make other compounds, too.

Other papers given by an international array of scientists (including 12 from USSR):

- Thrashed out problems in measuring high temperatures (over 1,500 F.).
- Filled in a literature gap on the flammability characteristics of combustibles in oxidants other than air.
- Described a new portable device developed by the Navy to detect and indicate the presence of explosive air-gas mixtures.
- Took a new view of the action of dry-powder fire extinguishers.

The symposium also learned that the Navy is now investigating a material that puts out fires in metal powders such as zirconium and titanium. Trimethoxy borane, made by Callery Chemical, burns along with the metal, but as it burns it deposits a film that cuts off the metal's oxygen supply.

New pulp treatment saves water

Arizona Pulp and Paper will put a new newsprint processing system into commercial operation next fall at Flagstaff. While saving water is the principal advantage claimed for the process, it's also said to reduce waste dumpage and eliminate odors. APP expects the method to spur newsprint processing in the Southwest and other timbered areas with inadequate water supplies.

By chemically pretreating Ponderosa pine to remove pitch and shed bark, mechanical crushing the wood into pulp and then blending in chemical pulp made elsewhere, APP says it needs only 3,000 gal. of water per ton on newsprint produced. Other processes use 10,000-30,000 gal./ton to bleach the pulp and remove the chemical content.

About chemical pretreatment, APP is silent, says only that it uses "one of the popular chemicals used in water treatment."

For more of WHAT'S HAPPENING.....113

IMPORTANT NOTES

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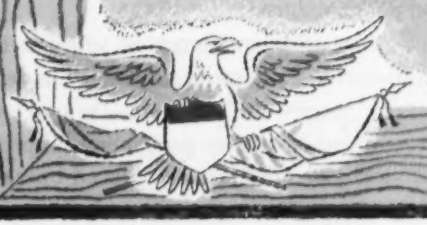

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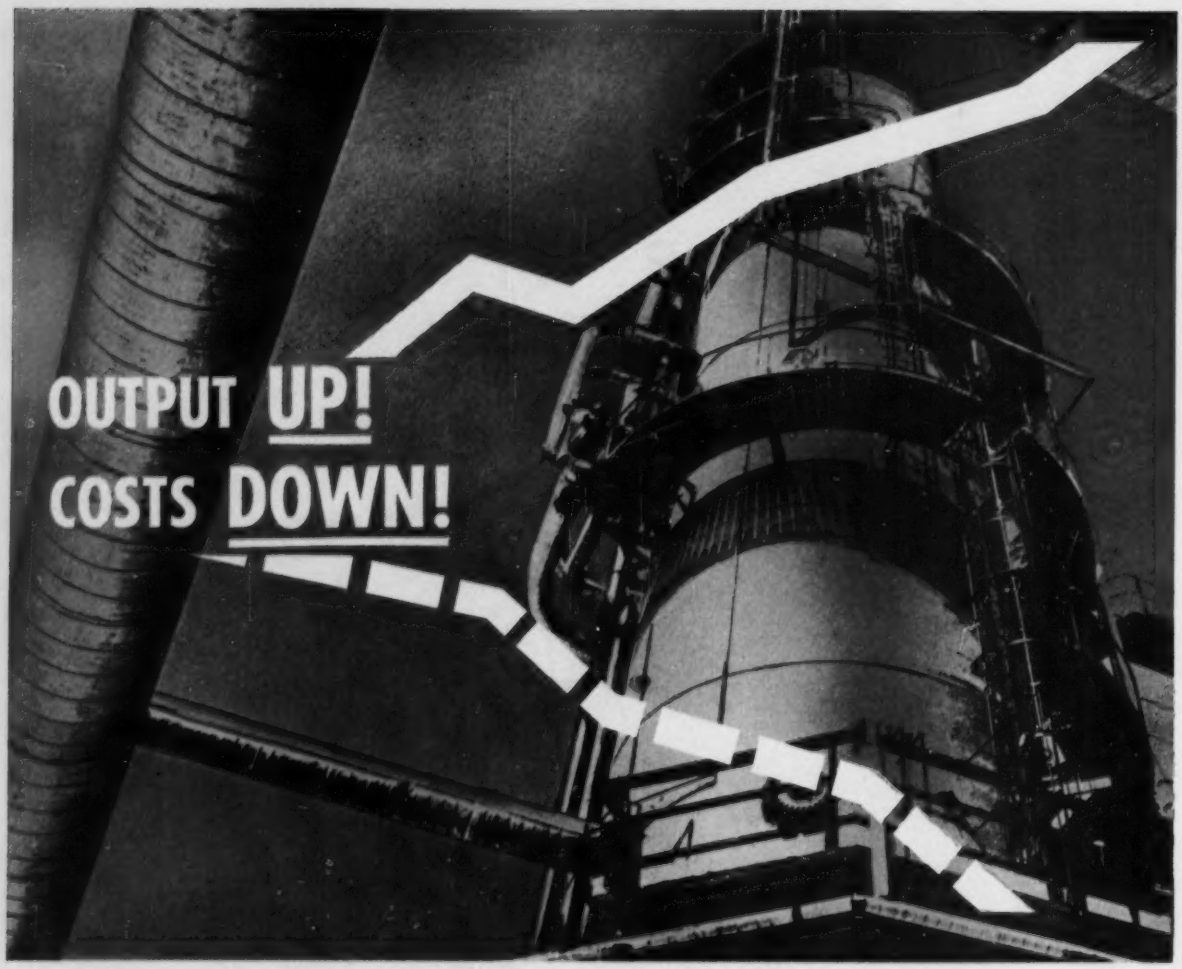
SHELL



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METEX Hi-Thruput Mist Eliminators provide virtually 100% removal efficiency, even at extreme temperatures and pressures. Pressure drop is negligible. Their outstanding performance is due to repositioning of the wires by the METEX patented Herringbone Fold . . . an exclusive development of the originators of knitted wire mesh entrainment separators. Impingement target area is increased and stagnation points reduced.

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6-201

METAL TEXTILE CORPORATION ROSELLE, NEW JERSEY

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What's Happening

OCTOBER 1956 FEATURE NEWS

- **Different Pulps Build Tailor-Made Product 114**

  Formation of laminated paperboard directly from any combination of kraft and hardwood pulps opens the way to optimum product performance at minimum cost.

- **Ion Exclusion Bids for Commercial Use 118**

  New process, now operating in demonstration plant, uses ion exclusion to remove dissolved salts from cane or beet molasses, boosting sucrose yield.

- **New Data to Ease Your Work 122**

  New tables of physical and thermodynamic properties, covering a wide range of chemicals, are on their way to help with your engineering calculations.

- **Kuwait Uses Four-Effect Flash Towers 126**

  Departing from convention, Westinghouse picks flash evaporation for simple design, low costs.

- **Aruba Employs Six Evaporation Effects 128**

  Special scale-control system features new unit designed to produce both electricity and water.

- **California Finds Three Effects Okay 132**

  Evaporator system compensates for lack of fresh water at power-plant site ideal on other counts.

- **Will Pulpers Go Steady? 136**

  Two different approaches to continuous cooking of woodpulp vie for industry attention, with commercial units of each type now operating in the U. S.

- **Convention Calendar 120**

Ice Warms Air In Winter, Cools It In Summer

A unique air-conditioning system that raises air temperature in the winter by making ice and uses the ice to reduce the temperature in the summer is now in service at the Stobie section of International Nickel Co.'s Frood-Stobie mine in the Sudbury district of Ontario.

A 198-in.-dia. fan with a capacity of 750,000 cfm. blows fresh air from the surface through a 300-ft. airway 20 ft. in dia. into two huge stopes (holes in the ground) arranged like a double-pass heat exchanger between the 300- and 500-ft. elevations. Each stope is 80 ft. wide, 200 ft. long and 200 ft. high. The air circulates through the two stopes in succession on its way to the mine intake.

Up to 200 gpm. of water at 120 psi. is sprayed from four spray points at the top of each stope. The fine water droplets turn to ice, and the heat of fusion is given up to the air. Some 40,000 tons of ice can be formed at the bottom of the stopes during the winter. Over such a period the heat from the ice combined with that absorbed by the air from the large area of wall rock totals 15 billion Btu.—equivalent to 850 tons of coal.

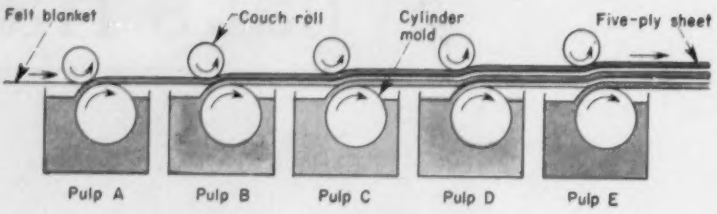
New Plant Dewaxes Lubes Via Urea Complexing

Standard Oil of Indiana is building the first U. S. plant for dewaxing lubricating oils via extractive crystallization with urea. Located in Whiting, Ind., it will produce more than 10 million gal./yr. of low-pour-point oils.

First such plant in the world went on stream last year in Heide, Germany. Operated by Deutsche Erodel A.G., it produces 50 tons/day of spindle oil. Urea's ability to form solid complexes with straight-chained molecules makes it possible to remove wax-forming hydrocarbons from oil by filtration.

In England, Shell Petroleum Co., Ltd., has a pilot plant using the process. In the U. S., Phillips and other oil firms have done a lot of work on the process.

Layers of Different Pulps



Build Tailor-Made Product

Formation of laminated paperboard directly from any combination of kraft and hardwood pulps opens the way to optimum product performance at minimum cost.

More economical use of raw materials and simplified production of laminated paperboard are the two chief claims for a new process now in operation at Crossett Co.'s new $16-million foodboard mill in Crossett, Ark.

Novel step in the process is the combining of separate layers of kraft and hardwood pulp —on the paper-forming machine—to produce a five-ply laminated sheet possessing the strength of kraft and the imperviousness of hardwood.

Crossett's particular application of this technique utilizes kraft pine pulp and neutral sulfite semichemical (NSSC) hardwood pulp to produce foodboard for milk cartons and paper cups. But the same idea may open the door to profitable uses of low-grade hardwood, for which there have been only limited and unprofitable markets in the past.

▶ **Cylinder Machine Over Fourdrinier**—Key to Crossett's process is a cylinder machine—chosen over the conventional fourdrinier because it's:

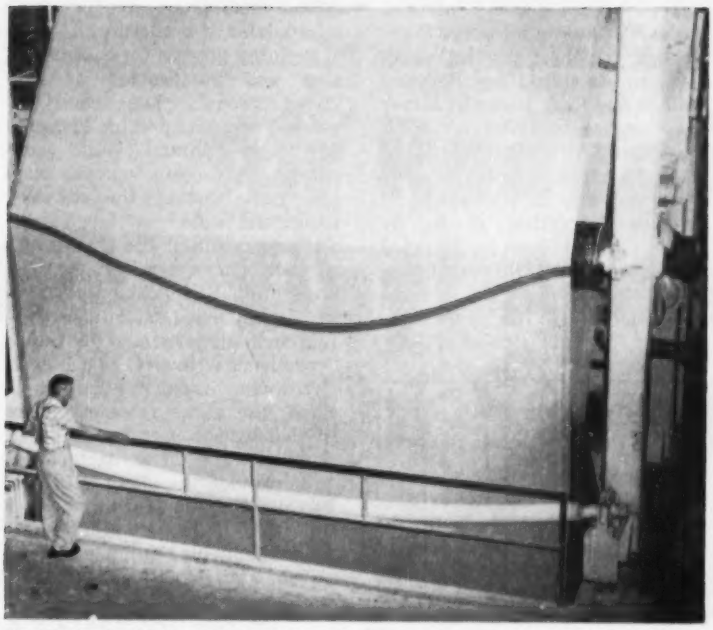
- Better adapted to making high-caliper boards (thick sheets composed of several plies of pulp).
- Better adapted to handling mixtures of pulps on the wet end.
- Permits controlled distribution of pine and hardwood pulps in the sheet where they will do the most good, thus enhancing the mill's ability to use the maximum percentage of hardwood with a minimum of pine pulp.

▶ **One of the Largest**—Crossett's board machine, one of the two largest in the world, is a 216-in., five-cylinder job with 60-in.-dia. cylinders which can run either uniflow or counterflow. On the wet end there's a suction drum press, two plain primary presses, a suction primary press and six dryers ahead of the third hot press.

The dryer section consists of a totally enclosed dryer hood, 53 felt dryers, breaker stack and size press.

Of the two sets of calender stacks, one is a seven-roll wet stack; the other, a nine-roll, steam-heated stack. After the dry stack, the sheet can either be wound on a reel for further rewinding or sheeted by a cutter in the machine line.

▶ **Maximum Flexibility**—Raw-material pulps, with compositions properly adjusted for



BLANKET, 216 in. wide, carries pulp layers through paperboard machine.

liner and filler stock system for the machine, are refined, then fed to each of the five forming cylinders.

Theoretically, each cylinder could handle a different pulp composition, thus allowing maximum flexibility in the blending of NSSC pulps with kraft pulp. Alternatively, a homogeneous furnish could be run on the cylinder machine (as on a fourdrinier), but that would lose the operating advantage of having a different furnish on the outer and inner board components.

▶ **Designed to Meet Company Specs**—Crossett's decision to build a foodboard mill was an outgrowth of several years' intensive research to discover what products and manufacturing processes would best fit objectives specified by the company's officers and board of directors in building a new plant:

- It must profitably make use of large quantities of hardwood.
- It must be integrated as far as possible with the company's existing paper mill.
- Its cost must be kept as low as possible for a minimum-sized commercial plant.
- It must be expandable with ease at minimum cost.
- Its product must have good growth potential and fit in with past manufacturing and sales experience.

Having determined that bleached foodboard made with a mixture of bleached pine kraft and NSSC hardwood pulps were, respectively, the product and process which would best fit the outlined objectives, engineers then selected the major pieces of equipment around which the mill is built.

These, except for the cylinder machine, are standard—stationary digester and blow tank for NSSC pulping, rotary washers and a four-stage bleaching plant using chlorine dioxide as the final stage.

▶ **Compares Favorably**—The new mill is designed for 150 tons/day production and can produce boards ranging from 0.011 to 0.040 caliper at speeds up to 450 ft./min.

Costwise, its cylinder machine is on a par with the fourdrinier. And performance-wise, company management claims that its products "compare very favorably with other boards now on the market."

Another Job For Sodium Borohydride

Sodium borohydride, making news in the U. S. as a source of high-energy fuels (*Chem. Eng.*, Sept. 1956, p. 112), has fallen heir to another new job—this time in the paper industry. Australian Paper Manufacturers Ltd. has found that it can be used: To increase the resistance of chemical pulps to alkali; to improve the filtration properties of cellulose xanthate solution in viscose rayon manufacture.

Cellulose pulps bleached by oxidation form aldehyde groups, resulting in compounds relatively low in alkali resistance. But research has confirmed the assumption that, because unoxidized cellulose is resistant to alkali, chemical reduction of aldehydes in oxidized celluloses to hydroxyls renders them resistant to alkali. Australian researchers find that sodium borohydride in very weak alkaline solution at room temperature accomplishes the reduction very effectively. Other reducing agents are either ineffective or require such drastic conditions that the cellulose fibers suffer extensive degradation.

In conversion of chemical wood pulps to viscose rayon, one of the main criteria for success is ease of filtering the cellulose xanthate solution before making the regenerated filaments. It has been found that sodium borohydride-stabilized chemical pulps give xanthate solutions which are easier to filter than those derived from unstabilized wood pulps.

B_{12}-from-Sewage Makes Plant-Scale Debut

First plant in the world to extract vitamin B_{12} concentrates from dried sewage sludge is now under construction at Milwaukee's municipal sewage disposal plant. To be owned and operated by Vern E. Alden Co. under exclusive contract with Milwaukee Sewerage Commission, the plant has a potential annual capacity in excess of 200 lb. of pure vitamin B_{12} activity. At first, only a portion of the total Milwaukee organic nitrogen,

called Milorganite, will be processed.

Armour Laboratories will take the entire output of the Alden plant and process it further at its Kankakee, Ill., pharmaceutical plant. Principal use of vitamin B_{12}, from a volume standpoint, is an additive for livestock and poultry feeds.

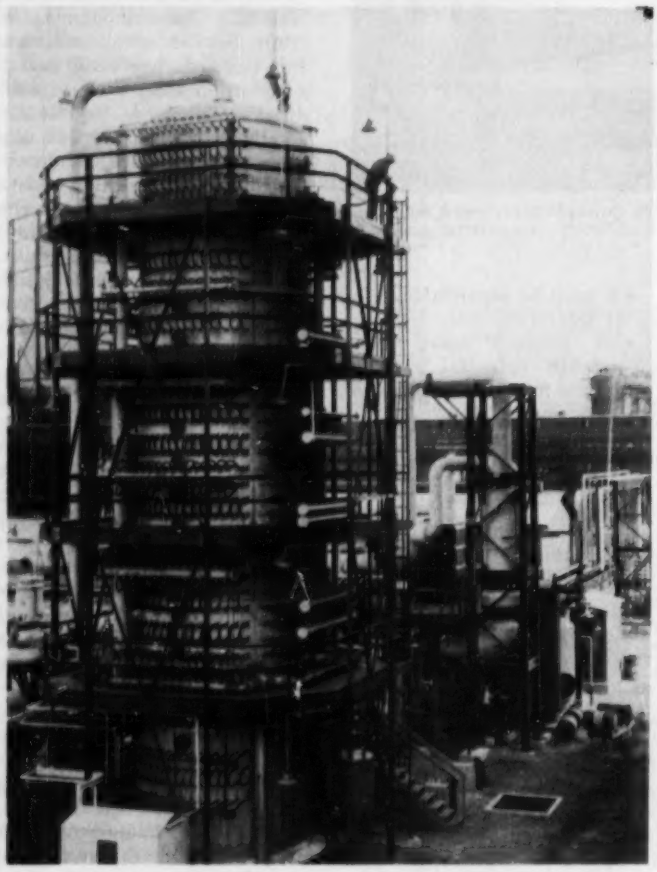
The extraction process was pilot-tested at Northwestern University by the Alden group at a cost of over $50,000. Patented by the Milwaukee Sewerage Commission, the basic chemical process was developed by Bernard Wolnak and C. S. Miner at Miner Laboratories in Chicago.

Coordinated with the existing activated-sludge process of sewage treatment in Milwaukee, it involves extraction of B_{12} by water, carried on in an agitated prewetter, with subsequent displacement washing on a horizontal table filter. Product is a spray-dried concentrate.

Refining process for concentration and purification of the Alden product has been developed and patented by Armour.

Another animal feed component—a protein source—may also come out of the sewage-treatment field. A large-scale pilot operation at the University of California's engineering field station at Richmond, Calif., is producing dried, sterilized protein-rich algae grown in interdependence with sewage bacteria.

Drawing its energy from sunlight, the algae release oxygen needed by the bacteria to break down sewage. The bacteria in turn provide the algae with carbon dioxide, ammonia and other nutrients. Sewage water is sufficiently purified for use in irrigation and industrial cooling.



Five-Story Absorber Bristles With Cooling Tubes

Absorber tower at Allied Chemical & Dye's new nitric acid plant in Hopewell, Va., is thought to be the largest of its kind anywhere. Stainless steel shell is 52 ft. high and 11.5 ft. in dia., weighs 15,000 lb., incorporates 3,400 cooling tubes. Also noteworthy: Plant power unit is almost completely self-sustaining; expansion turbines utilize energy supplied from oxidation of the ammonia gas during the process.

Horizons Modifies Electrolytic Ti Process

On the basis of a new electrolytic titanium process which has been in the experimental stage for two years, Horizons Inc. has been awarded a $200,000 development contract by the Navy Bureau of Aeronautics.

Successfully proven on a laboratory scale, the process is a modification of the company's original fused-salt electrolysis. Any commercialization of the new process would be carried out by Horizons' licensee, Horizons Titanium Corp. of New York. Horizons recently completed a contract for the Atomic Energy Commission covering the pilot-plant operation of a similar electrolytic process for producing a nuclear fuel metal, thorium.

Using its older electrolytic titanium process, the company operates a $564,000 pilot plant in Stamford, Conn. Potassium titanium fluoride serves as the electrolyte, graphite and iron as electrodes. Argon blankets the system.

To increase supply of titanium tetrachloride to present producers of titanium, Stauffer Chemical Co. is doubling capacity of its Niagara Falls plant. The company is just completing a previous expansion.

DESIGNING ENGINEERS AND CONSTRUCTORS

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Air Reduction's New Vinyl Acetate Plant On Stream

Engineered and constructed by Lummus, the $3,000,000 facility with capacity of 30 million pounds has smooth start-up; makes 99.99+% pure product.

The new $3,000,000 installation for the production of vinyl acetate monomer has recently gone on stream at Calvert City, Kentucky. Engineered and constructed by The Lummus Company for Air Reduction Chemical Company, a Division of Air Reduction Company, Inc., the unit started up smoothly and was immediately making 99.99+% pure product—even better than specification.

Designed for flexible operation, the 30,000,000 pound per year unit has proved operable in a wide range from ¼ of design capacity to over design capacity.

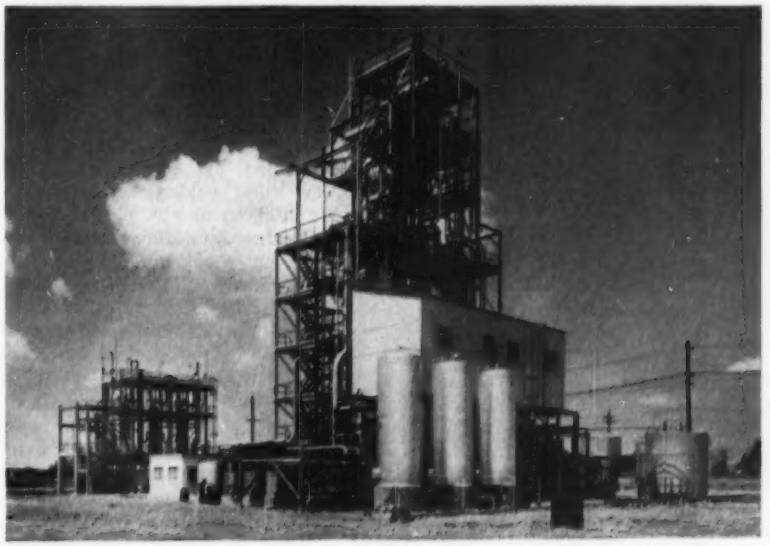
The plant is of outdoor construction throughout, with process control centralized in a modern control room employing electronic devices. It is located adjacent to Airco's National Carbide Division acetylene generating plant, from which it receives its principal raw material—acetylene. This is converted into vinyl acetate monomer which is, in turn, a basic material for adhesives, latex paints and textile finishes.

Airco executives who attended the formal opening commended the ability and dispatch with which the Lummus organization carried through the project from inception to completion.

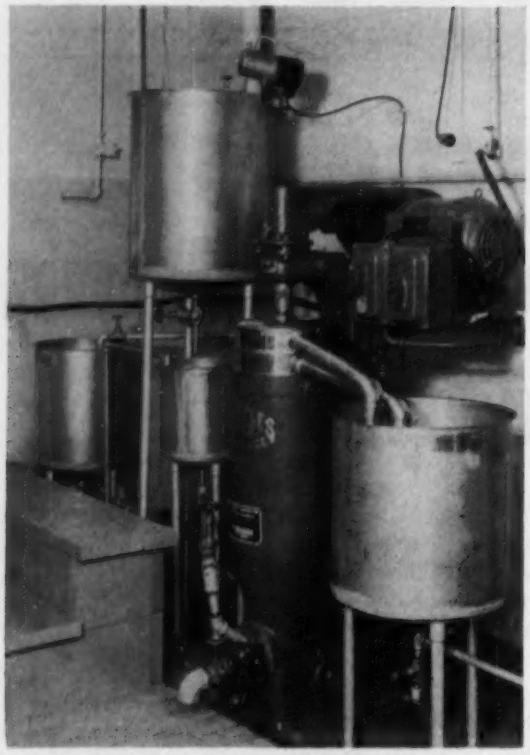
The success of this project is one more indication of Lummus' ability to handle exacting installations for the chemical process industries.

You may find it profitable to look to Lummus for your next plant project.

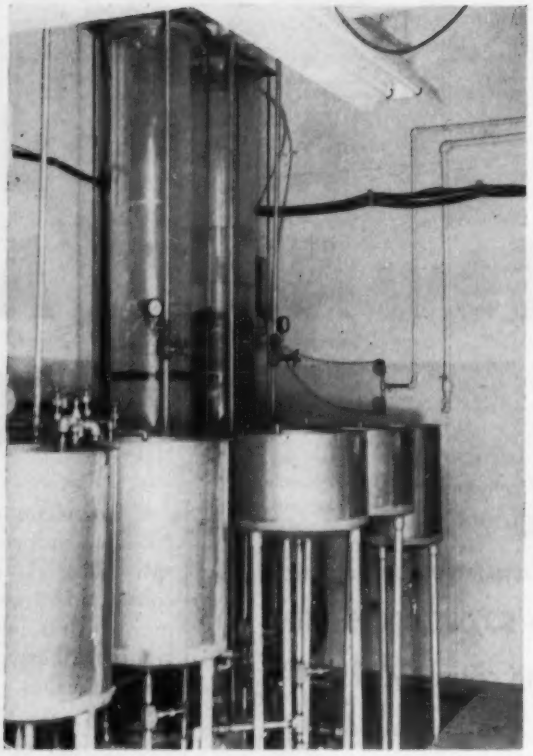
THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N. Y. **Engineering and Sales Offices:** New York, Houston, Montreal, London, Paris, The Hague, Bombay. **Sales Offices:** Chicago, Caracas. **Heat Exchanger Plant:** Honesdale, Pennsylvania. **Fabricated Piping Plant:** East Chicago, Indiana. **Engineering Development Center:** Newark, N. J.



Acetylene is purified in unit at left. In larger unit (center), preheated acetylene and acetic acid vapors react to form impure monomer. Distillation towers in this unit purify monomer and recover unreacted acetic acid.



CLARIFICATION prepares blackstrap molasses for . . .



ION EXCLUSION at new demonstration plant where . . .

Ion Exclusion Bids for Commercial Use

New process, now operating in demonstration plant, uses ion exclusion to remove dissolved salts from cane or beet molasses, boosting sucrose yield.

First commercial use of ion exclusion—a technique in which ionic compounds are separated from nonionics—appears near. Potential users: Producers of beet and cane sugar.

Sugar industry interest is focused on claims that the Ultra-Sucro B-molasses process can get 7½-10% more crude sugar from a given amount of cane or beet molasses. Industry representatives got their first look at a demonstration plant at Rockford, Ill., in early August.

Ion exclusion is a key step in the new process. It helps remove crystallization-inhibiting ionic materials from black strap molasses to allow recovery of more sucrose. The method was developed by Ultra-Sucro Co., New York, working with Illinois Water Treatment Co., Rockford, and using a modification of Dow Chemical's original ion exclusion scheme (*Chem. Eng.*, Oct. 1952, p. 234).

▶**How Ion Exclusion Works**—Though ion exclusion involves use of the same type of resin bed that's used in ion exchange, the two techniques differ considerably. In ion exclusion, ions are rejected, not retained, by the high ionic concentration within the resin particles.

Ionic materials pass quickly through the voids in the bed, while nonionic matter, which has no inclination to be either adsorbed or rejected, permeates the resin and travels more slowly through the bed. This difference in the speeds with which the materials move down through the bed is the basis of their separation.

After the ionic materials have passed through the resin bed, the slower-moving nonionics are removed by purging the bed with water. Unlike ion exchange, ion exclusion requires no costly or corrosive regenerating chemicals.

▶**Adapting It for Sugar**—Essentially, sugar production involves a series of crystallizations.

The syrup is initially clarified by addition of calcium hydroxide and phosphoric acid to settle the bulk of the impurities. But it still contains some insoluble impurities and dissolved mineral

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salts. After each crystallization the percentage of these impurities and salts rises, until they inhibit further crystallization.

Ultra-Sucro heats this noncrystallizable syrup (known as blackstrap molasses), dilutes it with water and adds more lime and phosphoric acid. Other reagents are also added to clarify the molasses but, since patents are still pending, Ultra-Sucro declines to identify these materials. Centrifugals remove suspended impurities from the molasses.

▶**Final Cleanup** — Although some of the ionic materials precipitate during this clarification step, further purification is necessary.

Passing clarified blackstrap through an ion exclusion unit takes out more than 90% of the soluble mineral salts, leaving a high-purity, brilliant syrup which is returned to the regular process for crystallization. The process also removes bacteria from the sugar.

▶**Economic Benefits**—According to Ultra-Sucro, the new process can be incorporated into now-operating sugar mills without disturbing existing equipment. As set up in the demonstration plant, the process operates as an auxiliary installation, readily adaptable to any cane or beet factory. It can be automatically controlled.

Higher yield of sugar provides a net economic advantage to the sugar producer, it is claimed, permitting amortization of the investment in extra equipment in fairly short order.

▶**Not Limited to Sugar** — Though economic conditions have brought ion exclusion closer to commercialization in the sugar industry than in other fields, it isn't limited to this application. Dow has used the method, on an experimental basis, to purify glycerine, ethylene glycol, acetic acid and various organic solvents.

In general, ion exclusion can separate any ionic, water-soluble solute from any low-molecular-weight nonionic solute. It is not even limited to organic nonionics. Salts, strong acids and strong bases can be separated from weakly ionic inorganics, such as ammonia and boric acid, too.

Big Petrochemical Plant Set for Canada

A $25-million petrochemical plant under construction in Sarnia, Ont., will be completed by Imperial Oil Ltd. by spring of 1958. Located near the company's Sarnia refinery and drawing feedstock from it, the new plant will produce ethylene, propylene, normal butylenes, isobutylenes, butadiene, aromatic distillates and tars.

Activity In Uranium: New Mills, New Refineries

New uranium processing mills are being built by Dawn Mining Co., subsidiary of Newport Mining Corp., and Eldorado Mining & Refining, Ltd., a Crown corporation.

Dawn is building a 400-ton/day, $3-million ore-processing plant at Ford, Wash., about 20 miles north of Spokane, schedules production for July 1957. The mill will give the Spokane area a completely integrated atomic program, from mineral to product.

Catalytic Construction Co. of Canada, Ltd., will design Eldorado's plant to produce uranium metal via uranium oxide. A process is now being tested in a Port Hope, Ont., pilot plant to produce uranium metal salt from purified uranium oxide.

Texas Zinc Minerals Corp., owned jointly by Texas Co. and New Jersey Zinc Co., will build a uranium processing mill to exploit its new stake in the Happy Jack mine in Utah. Uranium concentrate from the plant, to be built at Mexican Hat, Utah, will be sold to the Atomic Energy Commission. Scheduled on-stream date: September 1957.

Four Corners Uranium Corp. and Vitro Corp. of America recently signed an agreement whereby Vitro will process Four Corners' uranium ore from its Green River, Utah, mine. Four Corners will supply 3,000 tons/mo., may increase it to a maximum of 12,000. A new solvent extraction process is now being installed at Vitro's Salt Lake City mill, and further expansion is projected.

Convention Calendar

National Industrial Conference Board, Atomic Energy Course for Management, Biltmore Hotel, New York, Oct. 1-5.

Technical Assn. of the Pulp and Paper Industry, 11th plastics-paper conference, Conway Hotel, Appleton, Wis., Oct. 3-4.

Standards Engineers Society, fifth annual meeting, sessions on standards in the chemical industry and atomic energy field, Hotel Willard, Washington, D. C., Oct. 3-5.

American Institute of Mining, Metallurgical, and Petroleum Engineers, annual fall meeting of metals division, symposia on nuclear metallurgy and titanium, Hotel Carter, Cleveland, Oct. 8-10.

Society of the Plastics Industry, New England section conference, Wentworth Hotel, Portsmouth, N. H., Oct. 11-12.

American Institute of Chemical Engineers, New York section annual all-day meeting, features symposium on cost estimation, Hotel Statler, New York, Oct. 18.

Assn. of Consulting Chemists and Chemical Engineers, annual banquet and symposium, Hotel Belmont Plaza, New York, Oct. 23.

National Industrial Exposition, chemicals and nonmetallics day, Artillery Armory, Detroit, Oct. 26.

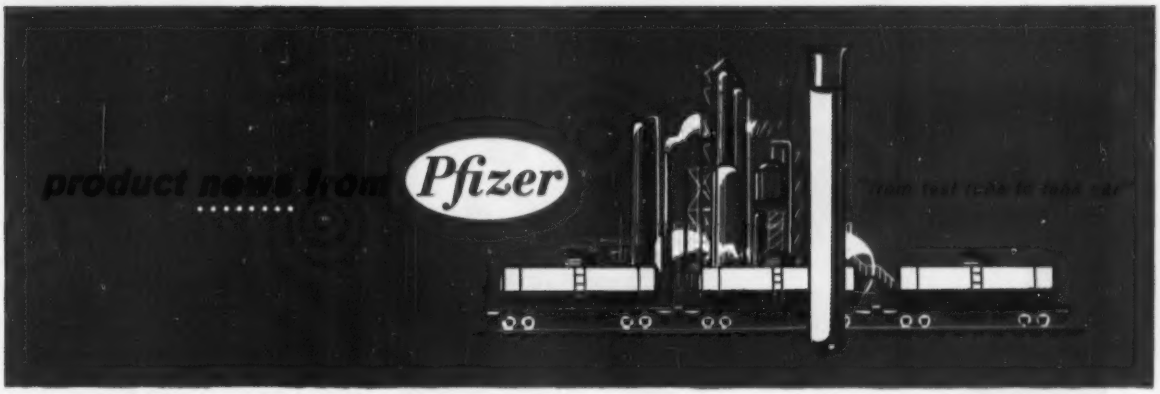
Commercial Chemical Development Assn., meeting on detergents, Terrace Plaza Hotel, Cincinnati, Nov. 1.

Fifth Annual Instrumentation Conference, Louisiana Polytechnic Institute, Ruston, La., Nov. 1-2.

American Council of Independent Laboratories, annual meeting, Savoy Plaza, New York, Nov. 2.

American Institute of Chemical Engineers, Chicago section all-day meeting, Conrad Hilton Hotel, Chicago, Nov. 7.

Third International Automation Exposition, Trade Show Bldg., New York, Nov. 26-30.



VERSATILE ORGANIC ACIDS AVAILABLE IN QUANTITY

● When Pfizer opened the world's first successful citric acid fermentation plant in 1923, the world price of citric dropped more than two-thirds! Since that time Pfizer leadership in fermentation chemistry has made many other useful acids available to industry in quantity.

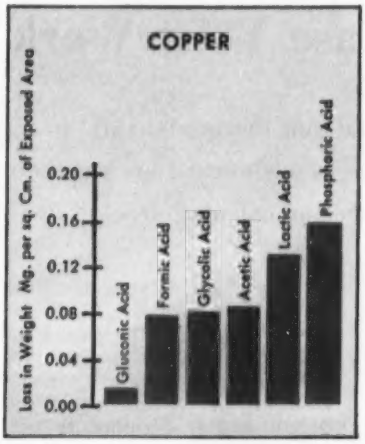
CITRIC ACID

Pfizer offers citric acid in both anhydrous and hydrous forms. With Pfizer's anhydrous form of citric acid, you save money in reduced freight costs. Why pay freight for 8½ lbs. of water per each 100 lbs. of citric shipped? In addition the anhydrous form offers the advantage of ideal quality control since there is little or no variation in moisture content.

Citric acid is a relatively strong acid notable for its nontoxicity, its sequestering ability and the number of chemical reactions it will undergo. Pfizer also offers citric acid salts and five esters in commercial quantities. These are Triethyl and Tributyl Citrates as well as their acetylated forms. Acetyl tri-2-ethylhexyl citrate is also available.

GLUCONIC ACID

By the fermentative oxidation of glucose, Pfizer produces gluconic acid, which it offers as a 50 percent aqueous solution and in the form of stable salts. Gluconic acid has a low order of toxicity, is extremely mild and non-corrosive and has excellent sequestering properties. Tests at Pfizer have shown that 1N gluconic acid solutions affected metals less than any of five other mild acids. Consider copper for example:



OXALIC ACID

Pfizer developed a fermentation process which yields oxalic acid in a high degree of purity. One of the outstanding features of this strong acid is its ability to solubilize iron oxide. Pfizer Oxalic Acid is available in granular and fine granular forms. Ammonium, ferric ammonium, ferric and other oxalates are also available.

TARTARIC ACID

Crystalline deposits in wine fermentation vats provided the raw material from which Pfizer began producing high purity tartaric acid in 1862. Like citric and gluconic acids, tartaric acid is notable for its low toxicity and its sequestering activity.

ITACONIC ACID

Pfizer skill in fermentation has made industrial itaconic acid a reality. Two carboxyl groups, a conjugated double bond and an active methylene group make itaconic acid a reactive and versatile molecule. Itaconic esters, readily prepared in high yields, can be polymerized and may serve as useful plasticizers. Polyesters of itaconic acid and glycols may be polymerized or copolymerized to hard thermoset resins.

You can order versatile PFIZER ORGANIC ACIDS in large tonnages. If you want further information on any of them, write us outlining the type of application you are considering. Pfizer Technical Service can help you with extensive data on organic acids.

PHYSICAL PROPERTIES OF ITACONIC ACID

Formula	$H_2C_5H_4O_4$
Molecular Wgt.	130.10
Appearance	white crystalline powder
Melting Point	167-8°C
Solubility in Water	
At 20°C.	8.3 Gm./100 ml.
At 80°C.	72.5 Gm./100 ml.

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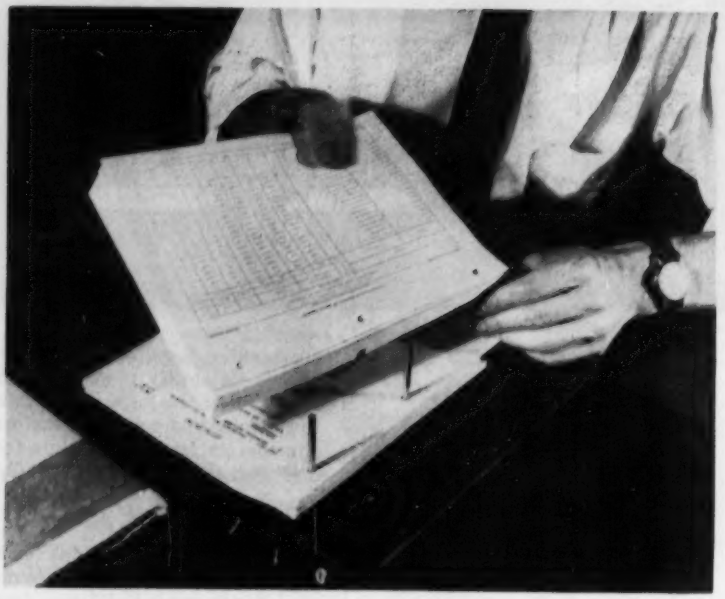

New Data To Ease Your Work

New tables of physical and thermodynamic properties, covering a wide range of chemicals, are on their way to help with your engineering calculations.

Talents of a six-man research team, directed by Carnegie Tech's F. D. Rossini and supported by a $40,000-per-year budget, are being pooled to make your work faster, easier and more accurate.

Engineers in the chemical process industries know that reliable, up-to-date tables of physical and thermodynamic properties are, to them, more valuable than Gray's *Anatomy* is to a surgeon.

That's why enthusiastic engineers and scientists in industry, universities and research centers are laying out a world-wide welcome mat for the tables of physical and thermodynamic properties of chemical compounds being prepared by a research project of the Manufacturing Chemists' Association.

▶**First Fruit of Big Harvest**—The MCA project recently bore fruit with the first set of tables distributed in March to MCA member companies. MCA expect to distribute the second set this month. The project got under way last year at Carnegie Institute of Technology, Pittsburgh, and is designed to supplement the International Critical Tables, last published in 1928.

The ambitious aims of the project are to produce—and maintain up to date—complete, self-consistent tables of data, covering ultimately all chemical compounds of interest to chemical industries.

▶**New Look Twice A Year**—To keep the tables up to date, MCA anticipates distributing new or revised data sheets as frequently as every six months.

The list of properties being tabulated is exhaustive, including—literally and figuratively—properties from A (total work function) to Z (critical compressibility factor).

Director Rossini indicates that the project will continue indefinitely, often concentrating extensively in a narrow field.

Currently the project is gathering data on nitrogen, phosphorus and halogen compounds.

▶**You Can Get Them**—MCA Secretary Maurice Crass states that distribution of the loose-leaf data sheets is made to three classes of recipients in the United States and 28 free countries abroad:

- Complimentary copies to MCA member companies.
- Gratis copies, one set each, to university departments (physics, chemistry, chemical engineering), free libraries, nonprofit research institutions and government organizations.
- Copies by sales (5¢ per sheet) to individual purchasers who subscribe to the entire set (not just a single installment).*

Copies will be available by sale to recipients in the above categories who want additional copies.

The first set of tables, totaling 107 pages, reports refractive index and density (at 20 and 25 C.), freezing points, boiling point and temperature coefficient of boiling point, dp/dt (all at 1 atm.) of the C_1-C_8 monohaloalkanes and the C_7-C_{10} normal 1-haloalkanes.

▶**Creates Reliable Values**—The project itself does no experimental work, but it's doing a lot of hard and often-frustrating digging for you.

Many values have been created by the researchers themselves, using correlations which extend the scope and strengthen the reliability of the tables. Indeed, reliability of the created values is at least equal to that of values based entirely on experimental data.

Research begins with *Chemical Abstracts* and ends, after a critical appraisal of methods, materials and results from all available pertinent literature, with the best possible value for the property of a compound. Some values from the literature are ruled out because of unreliable experimental procedure or impure materials. (*Continued*)

* Write Manufacturing Chemists' Association, 1625 I Street N. W., Washington 6, D. C.

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▶ **Correlations Extend Scope**—Values of given properties are correlated with:

- Temperature or pressure to obtain values for temperatures or pressures for which no data are available.
- Molecular structure (in the case of isomers and homologous series) to obtain values for compounds for which no data are available. Handling groups of structurally related compounds in this way strengthens the reliability of the individual values.

The MCA project is similar in many ways to the American Petroleum Institute's fifteen-year-old Research Project 44 on properties of hydrocarbon compounds. Also under way at Carnegie Tech and under Rossini's direction, API's Project 44 has tallied an impressive number of entries for well over 1,000 compounds.

Extensive fundamental research in these related areas promises to benefit the entire chemical engineering profession by speeding up calculations and eliminating the inaccuracies of interpolation, extrapolation and empirical rules.

Petrochemicals: U. K. Expands; Japan Invents

A strapping adolescent and a struggling infant recently got growth shots.

British industry is plowing another $101.2 million into its geometrically progressing petrochemical industry—now 40 times bigger in a decade.

Last month, on the other side of the world, Osaka University's Prof. Shigeru Tsutsumi watched startup of his 6½-ft.-high fluid-type cracking furnace to make ethylene and propylene directly from petroleum.

Largest U.K. petrochemical expansion is Imperial Chemical Industries' brisk $45.6-million, 50% boost in polyethylene capacity at Wilton—to over 100,000 tons/yr.

Esso Petroleum Co. will add a $36.4-million refinery project onto its $25.2-million petrochemical expansion program at Fawley. Total investment by completion in 1958 will be an impressive $190.4 million.

British Hydrocarbon Chemical's $22.4-million spurt at Grangemouth, Scotland, will add by 1957 duplicate cracking and gas-separating plants, a new butadiene extraction unit and a synthetic alcohol plant. Grange Chemicals, Ltd., owned jointly by British Hydrocarbon and the Oronite Chemical Co. of California, is building a detergent alkylate unit.

Chemstrand Ltd.'s $10-million acrylic fiber plant at Coleraine, Ireland, is in its first phase of construction. Monsanto, which owns part of Chemstrand, is talking with Esso Petroleum—probably about production of acrylonitrile, Chemstrand's raw material.

The Far East development at Osaka holds high hopes for Japanese petrochemicals. The novel cracking unit (there is said to be no such furnace in the U. S.) reportedly will yield 40% of its petroleum feed directly as ethylene and propylene. The recently completed furnace consists of catalyzing tank, heating unit, reaction tank and cooler.

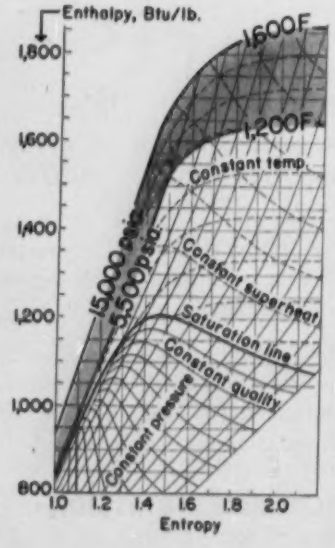
USI, Too, Will Make Ti via Na Reduction

U. S. Industrial Chemicals Co. is about to complete a 500,000-lb./yr. semicommercial plant which, using a sodium-reduction process, can produce titanium, hafnium, zirconium, thorium or beryllium. This new unit confirms *CE's* recent prediction (June 1956, p. 110) that USI would apply to other metals the process to be used at a projected 1.5-million-lb./yr. zirconium plant.

The smaller plant will be devoted to the production of zirconium sponge until construction of the major plant is completed. Both new facilities will be located at Ashtabula, Ohio, as will a third plant, a large-scale trial of a company-developed process for recovery of reactor-grade zirconium from hafnium-free scrap.

USI's will be the nation's second plant to use sodium reduction for titanium production. The first, recently put on stream in Ashtabula by Union Carbide's Electro Metallurgical Co. (*Chem. Eng.*, July 1956, p. 130), gets its supply of sodium from USI's Ashtabula operation.

New Data Will Extend Range of Steam Tables



This Mollier diagram shows the region that will be filled with data now being developed by the steam properties research project of the American Society of Mechanical Engineers.

Scope of the present Keenan and Keyes steam tables will be extended to 15,000 psia. and 1,600 F. Until enough experimental data are collected for a complete and authoritative table, however, ASME is making available an interim table ranging from 5,500 psia. to 10,000 psia. and 32 F. to 1,600 F. In the interim table, graphical and numerical methods, as well as actual data of United Aircraft Corporation, have been used. This table will find immediate use for modern steam-power and chemical plants.

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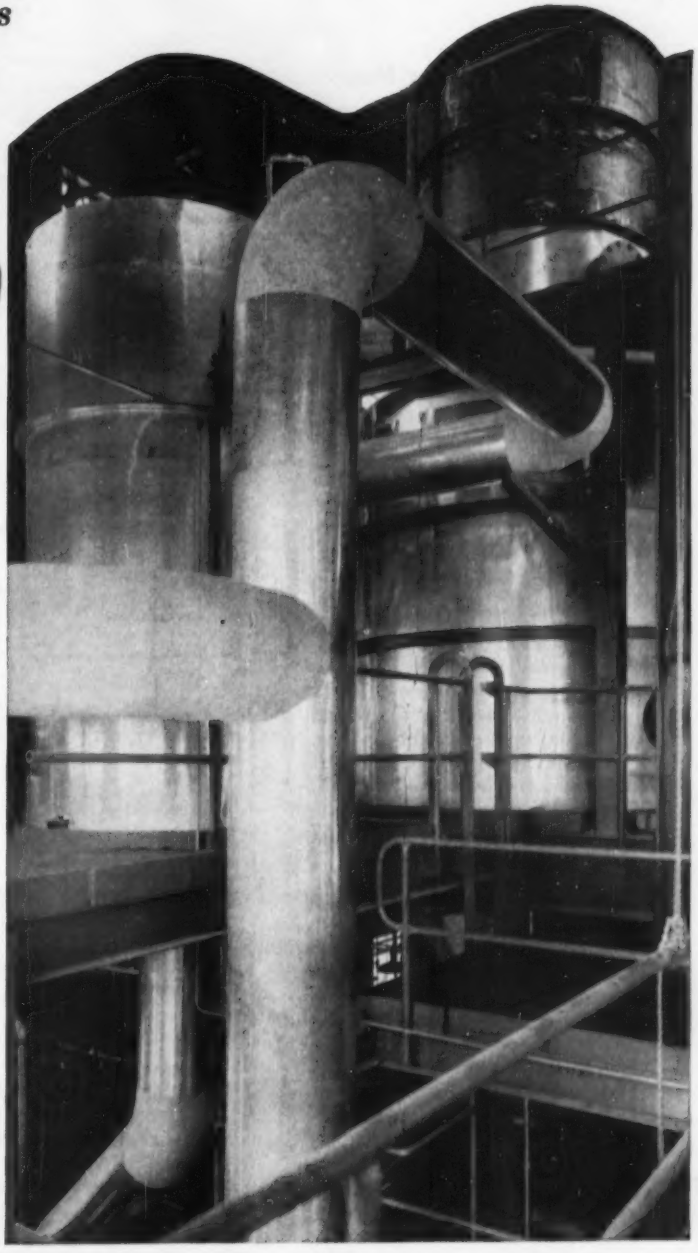

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WHAT'S HAPPENING . . .

Evaporation Plants Solve Water Shortages

- **Kuwait Uses Four-Stage Flash Towers**
- **Aruba Employs Six Evaporation Effects**
- **California Finds Three Effects Okay**

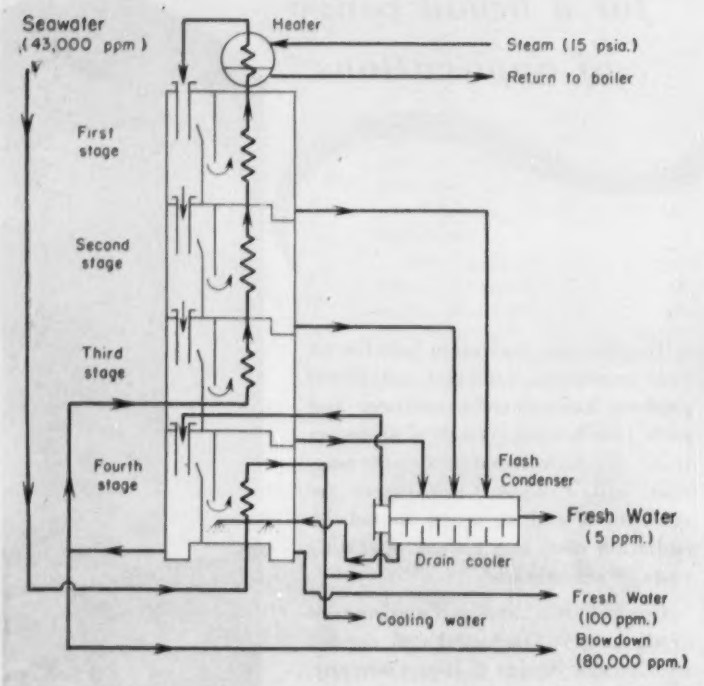
Fresh-water-thirsty areas, eyeing the ocean lapping at their shores, no longer need echo the Ancient Mariner's despairing refrain, "Water, water everywhere, nor any drop to drink." For modern multiple-effect evaporation plants are turning the seas into veritable reservoirs of potable water.

Plans for two huge new installations were announced in mid-summer—one for the island of Aruba, in the Caribbean Sea, the other for the sheikdom of Kuwait, on the Persian Gulf. They are being designed for respective production rates of 2.7 and 2.5 mgd. of fresh water.

Need for seawater evaporation plants is not confined to exotic outposts. Here in the U. S., Pacific Gas & Electric's Morro Bay (Calif.) power station is getting its boiler makeup water from the Pacific Ocean via triple-effect evaporation.

Process Alternatives—Multiple-effect evaporation, at its best, is a costly substitute for the processes of nature. That's why engineers today are hard at work on alternative processes, such as solar distillation, vapor compression, solvent extraction and electrodialysis (*see p.* 185). None of these has yet had a full-dress tryout.

Meanwhile, new engineering improvements have brought submerged-coil and flash evaporators to new peaks of efficiency, slashing costs and licking the scale problem. In the following three stories you will learn how this is being done.



Kuwait Uses Four-Stage Flash Towers

Departing from convention, Westinghouse picks flash evaporation for simple design, low costs.

To quench the thirst of its major city's mushrooming population (tenfold growth in the past five years) the small, oil-producing Middle-East Sheikdom of Kuwait needs more fresh water. And in that arid locale there's only one local source of water—the salty Persian Gulf.

Veteran water-maker Westinghouse Electrical International Corp. (New York) announced in July the sheikdom has ordered its biggest water-making plant to date—a 2.5-million-gal./day flash-evaporation system. To be built in two 1.25-mgd. steps—each consisting of two towers of four vertically stacked evaporators—the first package goes on stream next July, the second in September.

▶ **New Departure**—In electing the flash route Westinghouse departed from its traditional choice of submerged-coil evaporators.

According to N. F. Emig, Westinghouse engineer who closed the deal, "This scheme slashes the cost of making water by about 30%, from the $4.00/1,000 gal. figure of the three previous triple-effect plants we furnished for the sheikdom and for Kuwait Oil Co. (see *Chem. Eng.*, June 1951, pp. 212-4) to $2.80/1,000 gal." *(continued)*

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▶**Tower Design Cuts Cost**—Westinghouse credits big savings to the simple design of the flash evaporators and the novel idea of stacking four evaporators into a tower.

As L. W. Johnson, project engineer, puts it, "Flash evaporators are essentially just big steel boxes. They cost only about two-thirds as much as equal-capacity submerged-coil evaporators, and installations centered on them require a lot less accessory equipment."

Because the tower design uses 80% less floor space, the new units can be squeezed close to the sheikdom's present water facilities to take advantage of the equipment there. An added advantage: The large brine recirculation rate needed can take advantage of gravity flow through tower to save pumping cost.

▶**Economic Balance**—Aiming at further equipment saving, Westinghouse limited each flash train to four stages. Now getting about 3 lb. of fresh water for 1 lb. of steam, the plant could realize over 4:1 steam utilization with six effects.

But Westinghouse chose to throw some Btu.'s away in favor of saving the cost of extra equipment. For, as Johnson points out, "With all that cheap natural gas from the oil wells to burn in the boilers, we'd rather buy extra heat than steel."

▶**Low Temperature**—Less scaling is another reason Westinghouse likes flash evaporation. Its low operating temperatures inhibit the precipitation of solids from the seawater and reduce the scaling of equipment that destroys top heat-transfer efficiency.

Perhaps the ace terror of all seawater distillation schemes, scale formation comes unusually heavy with the high salinity of the Persian Gulf (at 43,000 ppm. nearly 30% higher than most ocean water). Determined to eliminate scaling entirely, Westinghouse engineers are studying the problem on a prototype plant in conjunction with Hall Laboratories, Pittsburgh (a division of Hagan Corp.).

▶**Chemical Treatment**—Johnson reports that chemical treatment of the feed water will keep the solids soluble in the brine, but as yet research hasn't fixed which chemical will do the job. Ferric chloride is under careful study but is considered too tough to handle by some.

At the existing Westinghouse-built Kuwait plants scale formerly was steamed off the equipment during 2-hr. daily shutdowns but is now controlled by chemical treatment. Johnson stresses, "This will be the case in the new plant; chemical treatment will keep solids in solution."

▶**Tower Operation**—Hot seawater feeds into a compartment held under vacuum, where it flashes off vapor, leaving a cooler, more concentrated brine. Vapor condenses on coils carrying cold seawater which, in taking up the vapor's latent heat, provides part of the preheat and drives off gases that promote corrosion. Brine from the first flash-evaporation stage feeds into a second compartment held at a still lower pressure, thus flashes again. And so on down the tower through the four stages.

In Kuwait's new plant each tower will measure 80 ft. high by 10 ft. wide by 40 ft. long and handle about 6,000 gal./hr. of seawater. Towers will be built of copper-bearing steel, fitted with bundles of copper-nickel tubes.

▶**Traveling the Flash Route**—Water from the Persian Gulf, at about 90 F., will be pumped via an 8-in. ceramic culvert through the tube bundle in the lowest (fourth-stage) evaporator (*see flowsheet*). In condensing the flashed vapor of this stage the seawater's temperature climbs to 112 F. Tower feed is next used as cooling medium for the flash condenser-cooler, where it reaches 127 F. Then it goes to the flash chamber of the fourth stage, along with brine from Stage 3.

Residual brine from the fourth stage passes upward through the tube bundles of the upper three stages, reaching 175 F. by the time it has condensed the flash vapors of these stages. It's finally heated to 200 F. via steam from the boilers. Then it begins its downward flow through the tower, flashing off water vapor under reduced pressure in each stage. Vacuum is obtained with steam ejectors using 150-psi. steam.

▶**Extra Flash for Boiler Water**—Condensate from Stages 1, 2 and 3 drains to a flash condenser where, under a lower pressure, additional flashing occurs to produce the small amount of 10-ppm. water needed for boiler makeup.

The rest of the water will be sprayed into the fourth-stage condenser to join fourth-stage condensate as 100-ppm. drinking water product. Though water of this concentration would taste salty to the temperate-zone dweller, (U. S. drinking water runs about 5-10 ppm. solids) it provides body salt lost in the burning desert heat of Kuwait.

Aruba Employs Six Evaporation Effects

Special scale-control system features new unit designed to produce both electricity and water.

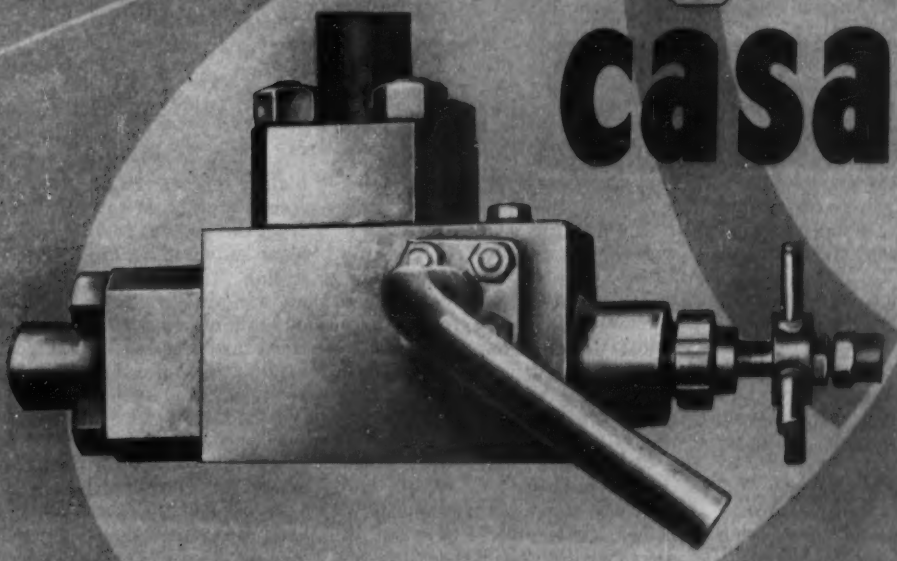
The island of Aruba, in Netherlands West Indies off the coast of Venezuela, needs more fresh water and electricity than it now has in order to attract industrial investment and a lively, rewarding tourist trade.

Singmaster and Breyer (New York), signed up by the Island Council as consulting engineers, has selected one stone which will kill both birds—a G. & J. Weir Ltd. (Glasgow, Scotland) evaporation plant which will produce 2.7 million gal./day of fresh water from the Caribbean Sea and also generate up to 12,500 kw. of electricity.

▶**Big But Economical**—One of the biggest single such plants ever planned, it will supplement a similar, smaller (690,000 gal./day) existing Weir plant and eliminate entirely the

for low-cost NH_3

FW casale



casale ejector eliminates recirculating compressor

Recirculating unconverted synthesis gas from the reactor, this simple ejector, with no moving parts, is one of many reasons for the economy, dependability and easy operation of the Casale process.

Five Casale plants for low-cost Ammonia synthesis, designed and built by Foster Wheeler, are in operation at higher-than-design capacity; three more FW Casale plants, with a combined capacity of 585 tons per day, are now in the design or construction stage.

For complete information on the cost-saving advantages of the FW Casale process, write for Bulletin 0-54-1. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

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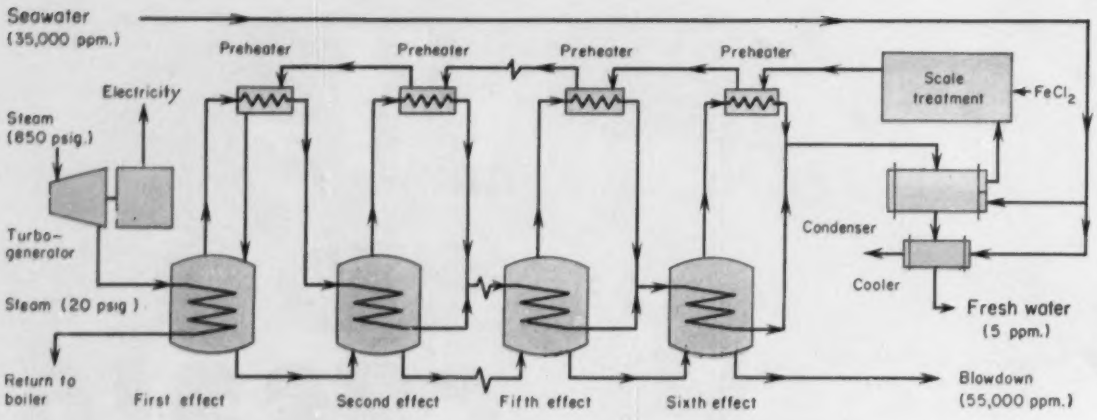

need for buying tanker ballast water. It will include five trains of six submerged-coil evaporators and will cost an estimated $10 million.

When it comes on stream in 1958 the new plant is expected to produce fresh water for half the present cost. Key to operating savings is a special method for preventing the formation of scale from concentrated brine on heat-transfer surfaces.

▶**Looked the Field Over**—S&B evaluated many other fresh-water-making schemes—from solar distillation to the far-fetched possibility of towing icebergs from the Arctic—before picking the Weir plant. Primary reason each alternative was discarded: No history of tested commercial experience. Conceding that the Weir plant may not represent the theoretically most efficient process, S&B thinks it is the only practical one to do Aruba's big dual job with guaranteed results.

S&B engineers give a good example of the reasoning that ruled out alternative processes. "Take vapor compression, a real promising and efficient scheme. Even if it were ready for commercialization on the big scale of the Aruba job—which it isn't—we couldn't have used it because it can't make electricity, and Aruba needs the electricity."

▶**Why Not Flash?**—Flash evaporation, a variation on the multiple-effect route that's had real commercial success, got a careful appraisal from S&B engineers, for it promises better heat efficiency than straight boiling.

But flashing concentrates salt water by only 10%, boiling by 50%. To produce equal amounts of fresh water, then, more brine must be circulated in a flash plant. Cost of power for pumping and heat lost during that action, in S&B's opinion, wipes out entirely the gains of higher thermal efficiency.

▶**Weir Beats Scale**—Key item that swung S&B to Weir's design was its successful approach to beating the worst bugaboo of seawater distillation—scaling of equipment by minerals dropped out of concentrated brine. Weir guarantees no scaling, thus promises Aruba continuous operation without the usual, costly shutdowns to knock heat-transfer-destroying scale off equipment.

Beating scale means keeping solids—mostly calcium carbonate, calcium sulfate and magnesium hydroxide—in solution. Just how it's done is Weir's secret. In principle, formation of $CaSO_4$ scale is prevented by controlling brine densities and evaporator pressures. Optimum pressures range from 19 psia. in first effect to 2 psia. in sixth.

Precipitation of $CaCO_3$ and $Mg(OH)_2$ is avoided by limiting the carbonate alkalinity. To do this, Weir uses an exclusive ferric chloride treatment of the seawater. A novel feature of the Aruba plant is that ferric chloride will be made right at the site.

▶**Halves the Cost**—The new plant, reports S&B, will slice Aruba's cost of water by 50%, from the present $3.50/1,000 gal. to an expected $1.75. Credit for saving goes mainly to lower maintenance costs and continuous production without interruptions for descaling. In fact, with a favorable price which the electricity may command in a growing industrial economy, water cost may be slashed even further.

An oil-fired boiler (with another on 100% standby) will produce 850-psig., 815-F. steam at a rate of 192,000 lb./hr. This will go through two turbine generators to produce 12,500 kw. of electricity and a 20-psig. discharge for evaporator use. S&B has designed tie-ins for additional turbines, to be supplied with steam from the second boiler, if more electricity is wanted.

▶**Evaporator Setup**—In making 5-ppm. (solids content) drinking water out of 36,000-ppm. seawater, the six evaporation effects will rely on the traditional Btu.-conserving trick of using vapor from one effect as the heating medium for the following unit. Result: 1 lb. of steam will make almost 5 lb. of fresh water. Train is limited to six units (seven or eight would have got better steam utilization) because the 130-F. vapor from the sixth effect is as low as can be effectively condensed with 85-F. seawater.

The horizontal evaporator bodies are made of cast iron. Steam coils fitted in each are small-bore admiralty bronze

For the 1st time! META-XYLENE in commercial production

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Typical tests of aircraft production

META-XYLENE	Meta-Xylene, % (wt.)	95.1
	Boiling Range, °C (start to dry)	1.0
	Specific Gravity, 60°/60°F	0.869
	Color, Saybolt	+30
	Sulfur Compounds, as H_2S or SO_2	None
	Paraffins, %	0
PARA-XYLENE	Para-Xylene, % (wt.)	95.4
	Boiling Range, °C (start to dry)	1.0
	Specific Gravity, 60°/60°F	0.865
	Color, Saybolt	+30
	Sulfur Compounds, as H_2S or SO_2	None
	Paraffins, %	0.20
ORTHO-XYLENE	Ortho-Xylene, % (wt.)	86.3
	Boiling Range, °C (start to dry)	1.2
	Specific Gravity, 60°/60°F	0.875
	Color, Saybolt	+21
	Sulfur Compounds, as H_2S or SO_2	None
	Paraffins, %	8.0

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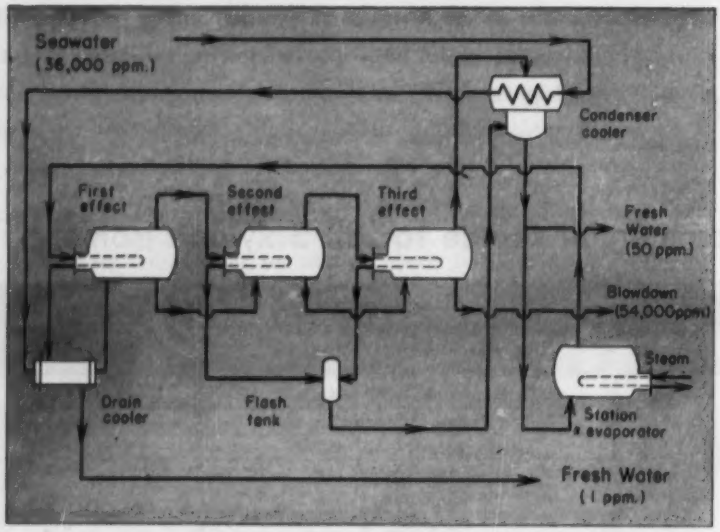
3001

tubes expanded in fixed headers at one end, into floating headers at the other end.

▶**Process Operation** — Sea water, at 85 F., is warmed by using it as coolant in the distillate condenser and cooler. It then passes through the "Scalemaster" for ferric chloride treatment. From there it flows through a series of six preheaters associated with the six evaporators. Heating medium in each preheater is the vapor from each effect on its way to the next.

Heated brine enters the first effect, is pumped from effect to effect down the train as it's concentrated. At 130 F. and about 55,000 ppm. salinity the brine discharges from the sixth effect back to the sea.

Some of the fresh water cycles to the boilers as makeup, bulk goes to supply the island's needs. Esso's big Lago refinery on Aruba plans to buy part of its water requirements from the new plant rather than importing it by tanker from Venezuela.



California Finds Three Effects Okay

Evaporator system compensates for lack of fresh water at power-plant site ideal on other counts.

In the shadow of California's mighty Morro Rock, Pacific Gas & Electric Co. found the nearly ideal site (Morro Bay) for a new 300,000-kw. steam-electric power station needed to drive San Joaquin Valley farmers' irrigation pumps. The 140-acre tract offered everything—handy highway and railroad network, good fuel-delivery facilities, easy electrical interconnection to the system—everything, that is, but fresh water, the lifeblood of this kind of installation.

Weighing this near-crippling lack against the site's shining advantages, PG&E elected to make its own water. Teaming with Bechtel Corp. (San Francisco), the power company came up with two triple-effect evaporator trains, at a cost of $400,000, to provide 144,000 gal./day of fresh water from the Pacific Ocean. Thus it became the first U. S. electrical station to be powered by "ocean steam."

▶**More on the Way**—Built in two packages—each train feeds through a boiler to power a 150,000-kw. turbine-generator—the first went on stream in 1955, the second is due this year. A. W. Bruce, PG&E senior engineer, reports that six more are scheduled for the future.

Half the water manufactured goes to the boilers, the other half furnishes general utility needs. (Morro Bay city facilities supply the drinking and sanitary water for the installation.) Taking the 36,000-ppm.-salinity ocean water, each evaporator train distills it to 50 ppm. for general use; a high-purity station evaporator distills the rest to less than 1 ppm. to meet the rigid boiler feedwater needs.

Bruce states the plant does this job—discounting labor costs—for about $2.60/1,000 gal. Labor doesn't enter the calculations, he feels, because additional personnel above those required anyway to run the station are not needed to make water.

▶**Keep Scale Off**—Scaling of equipment, from the sea's mineral deposits, had to be beaten to insure top heat-transfer efficiency. By running the evaporators under reduced pressures, the lower operating temperatures reduced these deposits somewhat. Liquid corn starch and disodium phosphate boiler compound, added to the seawater, cut the scaling still further. But still PG&E has to shut down periodically to knock off what scale persists in forming.

Each evaporator, built by Lummus, is a copper-bearing-steel shell, 6 ft. dia. by 20 ft. long, capped with a steel cover and bonnet. Steam circulates through a 1,050-sq.-ft. bundle of 70-30 copper-nickel tubes fitted in the first evaporation effect, through aluminum brass tubes in the second and third effects. Initial steam for the evaporation operation comes from the discharge end of the turbine. After that all steam requirements for each evaporator are provided by each preceding unit in the train.

▶**How Process Works**—Pumped through a 10-in. line, 90-F. ocean water from the station's auxiliary cooling water system passes first through a 1,150-sq.-ft. condenser-cooler, where it condenses and cools third-effect vapor and cools second- and third-effect condensate (*see flowsheet*). The

Look into "United" lead-lined products

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Under the trade name "United," National Lead Company manufactures lead-lined pipe in two categories..."United Tubond" and "United" expanded. Both combine the corrosion resistance of lead with the strength of steel.

"United Tubond" pipe is used where acid handling is difficult, where the lines are subject to external abuse, vibration, high internal pressure, elevated temperature or vacuum. In "Tubond" pipe the bond between lead lining and steel pipe is virtually inseparable.

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Whether you buy "United Tubond" or expanded, you may be sure you are getting a product with the grade of lead, thickness of lining, and method of joining calculated to give you your money's worth in strength and corrosion resistance.

Under the "United" brand you can also get the other components of a corrosion-resistant acid handling system — valves, fittings and pumps.

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seawater here climbs in temperature to 106 F. It is used next to cool first-effect condensate, then enters the first-effect evaporator preheated to 122 F.

The seawater proceeds through the three effects in conventional forward flow and returns to the ocean at a solids content of 54,000 ppm. The evaporators are held under reduced pressure by a two-stage, twin-jet ejector, using 600 lb./hr. of 200-psig. steam.

The 50-ppm. product from the condenser-cooler is split; half goes to a 500,000-gal. standpipe for general use.

The other half goes to the high-purity station evaporator. Here it is evaporated to produce 1-ppm. vapor, which provides first-effect steam before going to boiler makeup. The station evaporator is heated by turbine-bleed steam at 56.5 psia. and 530 F.

New Plant Taps Bark For Silvichemicals

Pacific Lumber Co.'s new 10-million-lb./yr. redwood bark extraction plant at Scotia, Calif.—the first large-scale silvichemical operation based on bark—inverts usual procedures, produces end-product mixtures of complex organic acids (mostly phenolic) and byproduct board, insulation and other conventional products.

Previous commercial silvichemical ventures (vanillin, alcohol, dimethyl sulfide, for example) have been based on wood and pulp liquor wastes.

Palco's process has two features unique in the forest products industry: An air conveyor (instead of the usual fans) for blowing chips, shreds and dust from the hammer mill to a continuous digester 500 ft. away; a flexible digesting process capable of tailor-making products. These products are composed of simple molecules (average molecular weight 400, compared to 12,000 for waste-liquor lignosulfonates), are more soluble (0.02% water-insoluble) and relatively free of methoxy groups.

The cooking process lasts about an hour at 115 to 135 psi. steam pressure and associated saturation temperatures, but may be varied, along with pressure, temperature and reagents, to make products with varying properties. The fibrous residue is processed into conventional forest products.

Palco is marketing its products on the basis of end use as well as on chemical and physical properties. Some of the most promising applications are as dispersing agents, phenol and tannin replacements. Two current products—both priced at about 8¢/lb.—are Palconate, a caustic extract, and Palcotan, a sulfonated extract.

Chromatograph Automatically Analyzes Refinery Gas

Two chromatographs newly incorporated into process flow lines at Esso's Linden, N. J., refinery are the first tailor-made for automatic analysis of refinery gases. Half-hourly on-the-spot analyses now replace once-a-day laboratory jobs. Developed by C. W. Skarstrom, above, the $12,000 unit consists of a 20-ft.-long coil packed with activated alumina through which dry air propels samples. Detector is bed of activated carbon which gives up different heats for each component.

Canada Now Has Own Lithium Grease Industry

Canada, which previously has imported virtually all its lithium greases from the U. S., now has its own lithium grease industry capable of supplying all its needs, with capacity for export.

Surpass Petrochemicals Ltd. at Scarboro, Ont., is now producing over 20 million lb./yr. of lithium greases. Previous imports from the U. S. totaled approximately 12 million lb./yr.

Surpass will also produce other petrochemicals now imported from the U. S.

ADSORPTION IS A BASIC CHEMICAL ENGINEERING PROCESS

DARCO Digest

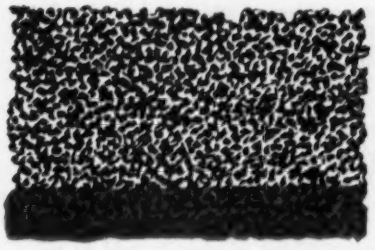
CHEMICALS DIVISION, ATLAS POWDER COMPANY, WILMINGTON 99, DELAWARE • Atlas Powder Company, Canada, Ltd., Brantford, Ontario, Canada

HOW DENSITY OF CARBON AFFECTS ECONOMY OF ADSORPTION

Retention becomes especially important when the product you're treating has appreciable cost per pound. A denser carbon can more than pay for itself in increased yield.

High density also cuts labor costs at the filter. A filter of given size holds more weight of a denser carbon . . . thus can process more liquid containing a given carbon dosage per gallon. The longer the filter goes between cleanings, the less your cost for labor per gallon of treated liquid.

Because it is porous, activated carbon always retains some of the liquid which you are purifying. Part of the



liquid is held in the space between carbon particles. You can recover this retained liquid by blowing the used filter cake with air, steam or inert gas before the filter is opened.

An approximately equal amount of liquid remains in the internal pores of the carbon. This liquid is not recoverable by blowing. If you are purifying a crystalline material in solution, you can wash the filter cake with water. In sugar refining, this process is called "sweetening off." The resulting sweet water is then returned into the process stream to recover the sugar that had been caught in the filter cake.

The density of the carbon you're using determines how much liquid is retained. In general, the denser the carbon the less the retention . . . because the smaller the volume of carbon you have the less liquid is lost. A relatively fluffy carbon, weighing 15-17 pounds per cubic foot, may retain 2 pints of liquid per pound even after blowing the filter cake. A dense carbon—such as any of the standard DARCO grades—weighing 25 pounds per cubic foot, retains only half as much per pound.

We at DARCO will be glad to consult on your particular adsorption problem, and to help analyze recovery methods and retention economies.

Need to remove a lot of color?

Sometimes you're faced with the need for removing so much color from a solution that ordinary grades of activated carbon would have to be used in uneconomically large dosages. Don't throw up your hands in despair—we've got a special grade of DARCO designed for just such work.

It's called DARCO KB. It has especially high adsorptive efficiency—which means that it takes less to knock out color. And it has a high bulk density—which means that your filtering, handling and storage costs are less.

We often recommend DARCO KB for decolorizing such things as monosodium glutamate, plasticizers, methionine, waxes and oils. We'll be glad to send a sample and to consult on selection of the DARCO grade that best fits your use.

IMAGINEERING with activated carbon

Looking at adsorption as a process of concentration opens up some intriguing possible applications . . . often far removed from the usual decolorizing and purifying uses.

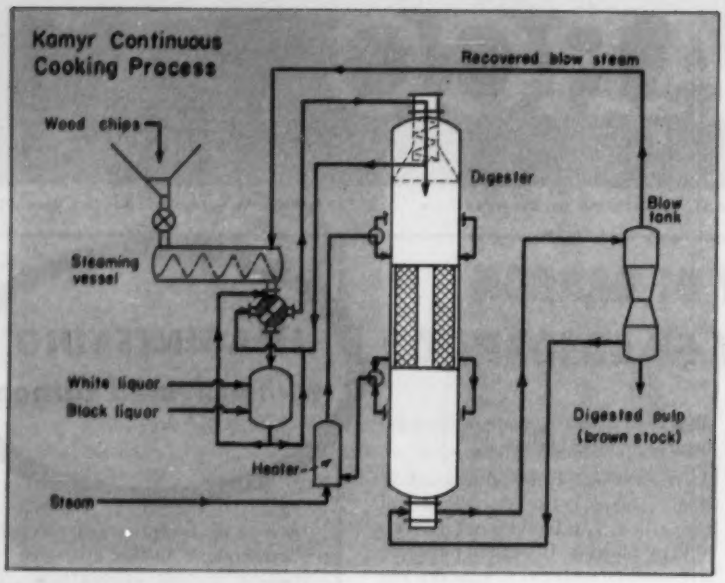
A number of possible uses of this idea are suggested. How about fertilizers, for example? A seed newly planted in the ground might be destroyed by a big initial dose of fertilizer. But suppose we supply the seed with a source of nutriment that would be gradually fed to it. Activated carbon might do the trick in the form of a carbon coating on the seed, loaded with adsorbed fertilizer.

How about an insecticide that wouldn't be washed away by rain? Activated carbon could serve as a reservoir for toxicant. Applied to fruit trees, insecticide-bearing carbon dust might slowly diffuse protective chemicals.

Adsorption means concentration of an adsorbate on an interface. Suppose that we think of using carbon not to remove something, but to maintain a concentration of something that we want to hold in reserve and release slowly over a period of time.

In other words, activated carbon could serve the purpose of a reservoir. By virtue of its ability to concentrate materials, it could hold within its large pore structure adsorbable material which would be available for controlled, gradual release when needed.

Whenever your imagination cooks up some unique way to put adsorption to work, we'll be glad to hear about it, and to offer suggestions that may help to turn a brainstorm into reality.



Will Pulpers Go Steady?

Two different approaches to continuous cooking of woodpulp vie for industry attention, with commercial units of each type now operating in the U. S.

Prospects for putting the cooking of pulpwood on a continuous basis in the United States are now brighter than ever.

The Swedish Kamyr process made its U. S. debut in June in a 150-ton/day unit operated by International Paper Co.'s Southern Kraft Div. at Camden, Ark. Weyerhaeuser Timber Co. expects to complete a like-sized installation in Longview, Wash., this fall. Early next year Gulf States Paper Corp. will bring on stream a 300-ton/day outdoor unit in Demopolis, Ala., and North Western Pulp and Power Ltd. will complete a 500-ton/day installation in Hinton, Alberta.

▶**Vertical Tower**—The Kamyr process is a straightforward adaptation of batch digestion equipment to continuous pulping. A tall, vertical tower (e.g., 90 ft. high, 13 ft. dia.) impregnates and digests wood chips under normal conditions of time and temperature.

Kamyr achieves continuous, controlled feed and discharge by: A high-pressure rotary feeder; operation of the entire liquid-filled digester under hydraulic pressure so that liquor and chips gravitate together to the bottom.

▶**Horizontal Tubes**—Somewhat better established in its bid for replacing batch digestion in the U. S. pulp industry is the horizontal multitube continuous digester (see *Chem. Eng.*, Jan. 1955, pp. 300-303).

This technique takes a more daring step away from standard pulping practice. The digester consists of an unfamiliar-looking series of relatively small horizontal tubes (e.g., two to eight tubes on the order of 36 in. dia., 21 ft. long) stacked in a vertical tier and joined by connecting necks. A screw feeder introduces the chips against digester pressure, and cooking mass is propelled through the tubes by conveyor screws. Operating temperatures are markedly above normal, and cooking times are correspondingly shorter.

▶**Produce High-Grade Pulp**—Multitube continuous units have been used commercially for about a decade to produce relatively coarse fibers for such products as corrugating media. Recently they have been modified so that now their several manufacturers look forward to wide markets in production of high-grade kraft or semichemical pulps. Such prospects are inviting further competition. For example, Sprout-Waldron has a unit under development which is expected on the market soon.

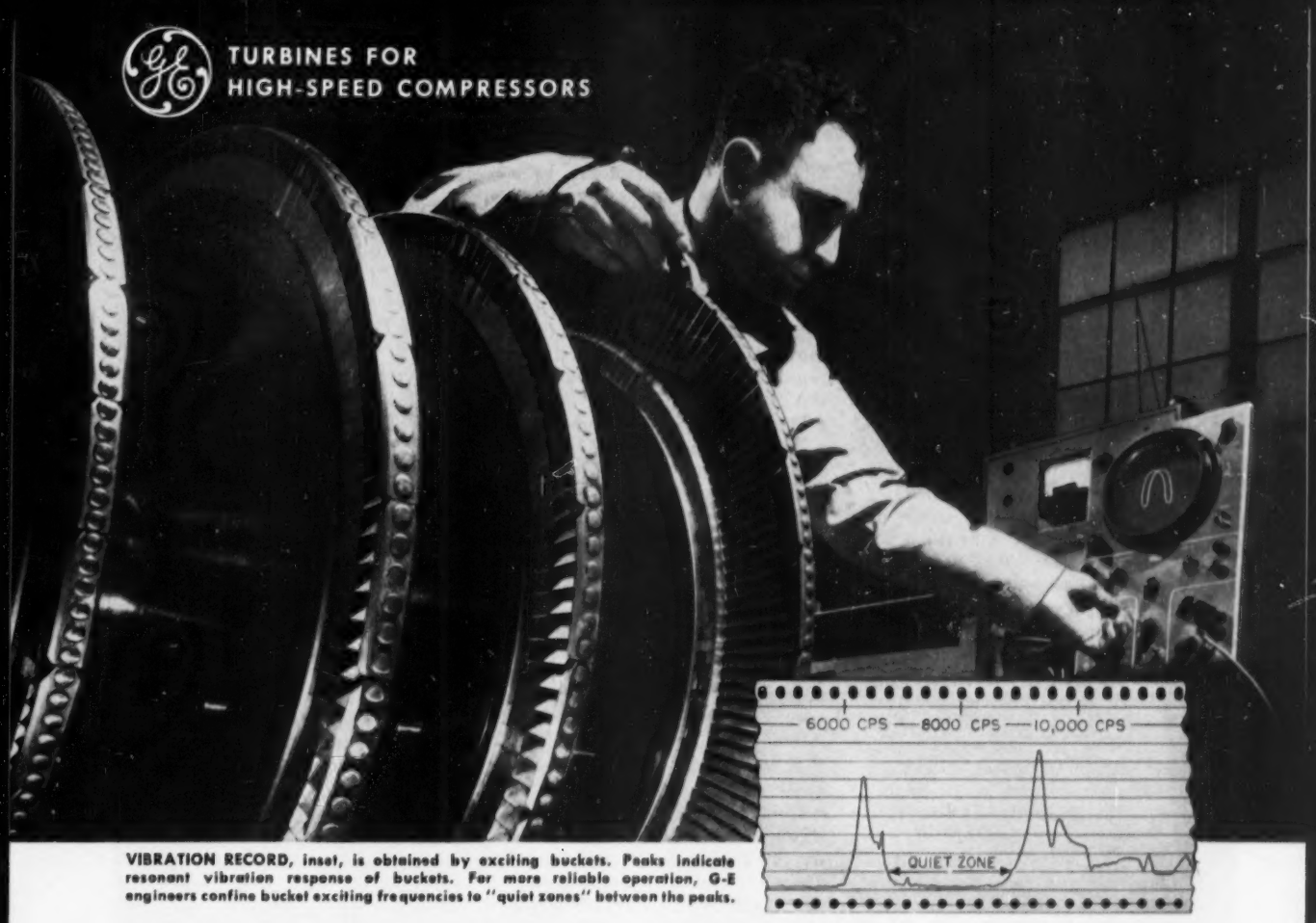
Pandia, Inc. (division of Black-Clawson Co.), has already supplied two commercial installations in the high-grade pulp field: Since 1952 Champion Fibre Co., Canton, N. C., has been producing 60 tons/day of semichemical pulp using six 36-in.-dia. tubes to digest oak and veneer cores; since January 1956 Potlatch Forests, Inc., Lewiston, Idaho, has been producing 125 tons/day of bleachable kraft from sawdust. On Pandia's order book: A unit for Crown Zellerbach's Camas, Wash., mill and one for Gaylord Container's Bogalusa, La., mill, both to produce bleachable kraft.

▶**Kamyr's Benefits**—Kamyr's North American units will all produce high-grade kraft pulp, though the process is said to be capable of yielding kraft or semichemical pulps of any known commercial grade.

Kamyr's claims to benefits are typical of those generally associated with batch-to-continuous transitions: An acceptable product of somewhat greater uniformity than batch product; less labor, building space and power; chemical savings via low liquor-to-wood ratio. For power, batch digestion usually requires about 4,000 lb. of steam per ton of pulp produced, compared to Kamyr's 2,000-lb. requirement. Liquor-to-wood ratio in batch processes is about 4:1; for Kamyr, it's 2.5:1.

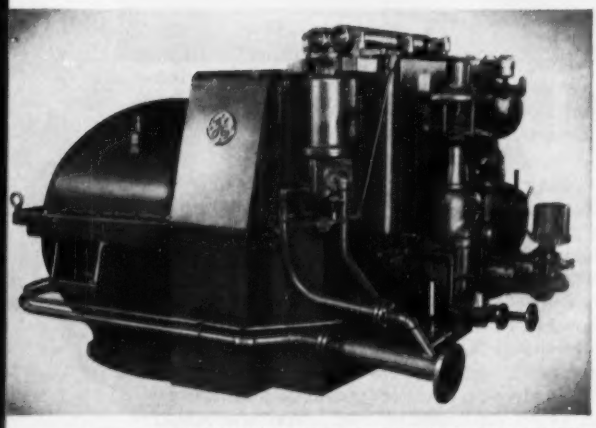
▶**Vs. Multitube Claims**—Multitube manufacturers claim all Kamyr's benefits and this much

TURBINES FOR
HIGH-SPEED COMPRESSORS



VIBRATION RECORD, inset, is obtained by exciting buckets. Peaks indicate resonant vibration response of buckets. For more reliable operation, G-E engineers confine bucket exciting frequencies to "quiet zones" between the peaks.

How G-E Engineers Locate "Quiet Zones" for Safer High-speed Turbine Operation



TYPE DRV HIGH-SPEED MECHANICAL-DRIVE TURBINE

When driving modern compressors and blowers, G-E high-speed turbines spin at operating speeds of 7000 rpm and up. At such speeds, if resonant vibration were not controlled carefully, bucket fatigue failure might result.

HERE'S HOW General Electric combats the problem: Natural vibration frequencies of the buckets on each new turbine rotor are determined with the special equipment shown above—an oscillator, crystal pick-up, and high-speed level recorder. "Quiet zones" of minimum normal vibration are clearly revealed.

With this information available, the number of nozzles can be varied so that steam striking the buckets will create vibration-exciting frequencies only in these "quiet zones." By thus making sure that steam-impact frequencies don't coincide with critical natural frequencies, the chance of bucket failure is greatly reduced.

VIBRATION TESTING is one of many features that add to the reliability of G-E high-speed turbines. For more information, contact your nearest G-E Apparatus Sales Office or write for Bulletin GEA-6232, General Electric Company, Section 241-2, Schenectady 5, N.Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

more: Because the units operate at temperatures between 180 and 185 C. (compared to 170-175 C. for batch or Kamyr), processing times are between 35 and 60 min. vs. 2 to 4 hr.

As to space savings, a batch digester producing, say, 200 tons/day would require 9,000 cu. ft. of space. Kamyr would require 5,000 cu. ft., and the multitube method would take 2,100 cu. ft. Batch space would probably be distributed among three 3,000-cu.-ft. digesters; Kamyr would use one 70-ft.-high by 10-ft.-dia. tower; multitube digestion would take six tubes, each 38 ft. long and 48 in. in dia.

▶**How Kamyr Operates**—Kamyr meters chips into a low-pressure steaming vessel where much air and turpentine are driven off. The use of flash steam from the blowtank and digester top relief for this heating also serves to concentrate most of the objectionable kraft mill odors in a single line—a step toward air-pollution control.

Heated chips are then introduced directly into the digester with fresh cooking liquor at a pressure of 140-150 psi. Temperature is in the neighborhood of 100 C. and, under these conditions, penetration is completed rather rapidly.

Feeding against pressure without damaging the chips and without danger of backfire has been accomplished by a rotating feeder. Pressure is balanced by a pocket going diametrically through the rotor. The pocket is provided with a screen in the middle. With the pocket in the vertical position, the chips introduced are retained while the liquor is passed through. With the pocket in the horizontal position, its load of chips is carried out and conducted to the top of the digester by means of circulating liquor.

▶**Uses Gravity**—The chips move downward by gravity through the heating zone and cooking zone. Black liquor introduced at tower bottom puts the whole digester under hydraulic pressure so that chips and liquor travel at the fixed rate of feeding. Both liquor and chips reach bottom together, chips digested and liquor exhausted.

Cooking heat is supplied by a strainer girdle in two separate halves, with a pump circulating the liquor horizontally across the digester. Every few minutes the circulation is reversed in order to improve temperature distribution and to free the fibers adhering to the strainer, permitting a regular downward movement of the pulp.

At the tower's bottom cone, a scraper dilution system insures uniform feed to the continuous blow valve. The cooked stock is blown into an hourglass-shaped blowtank, the neck of which effectively isolates the two sections and allows different temperature conditions to exist. It is, therefore, a simple matter to maintain 5-8 psi. steam pressure and corresponding temperature in the upper section for maximum heat recovery while diluting and cooling the stock for washing in the lower section.

▶**How Pandia Runs**—The Pandia digester, representative of the multitube group, is fed from an auxiliary bin to a hopper mounted on a specially developed screw feeder. Feeder compresses chips only 50% and, says a Pandia spokesman, there is no permanent deformation of these chips.

Also, steam and liquor are successively delivered to the first tube, where Pandia does its impregnation, heating and straining. Digestion takes place in the remainder of the tubes. In any given installation, the number of tubes is determined by the tonnage and cooking time required, as well as by the nature of the stock being cooked.

▶**Propels by Screw**—Cooking mass is propelled along by conveyor screw at a constant, controlled rate, mixing continuously as it travels. Because tubes are not completely full, noncondensables pass continuously through the upper segmental void in the tubes toward the discharger and are thus continuously purged with the blow.

Discharge valve is, in effect, a continuous blow valve through which pulp is propelled from the high-pressure digestion zone to the atmosphere. Usually, discharged pulp and gases are separated in a cyclone.

News Briefs

Silicon: Du Pont has bought land near Brevard, N. C., as a possible site for a silicon plant. Location was dictated by the extreme requirements for air purity in manufacturing hyper-pure silicon.

Polyvinyl acetate: A polymerization plant with an initial annual production of 10 million lb. of polyvinyl acetate has been opened at Demopolis, Ala., by Borden Co.

Intermediate polyethylene: More linear than conventional polyethylene, but made by the same high-pressure methods, an intermediate polyethylene resin has just been put into commercial production by Bakelite. Du Pont and ICI brought out similar resins last spring.

Synthetic rubber: Buna-Werke Huels in Marl, Germany, plans to start 45,000-ton/yr. production of cold rubber in the summer of 1958.

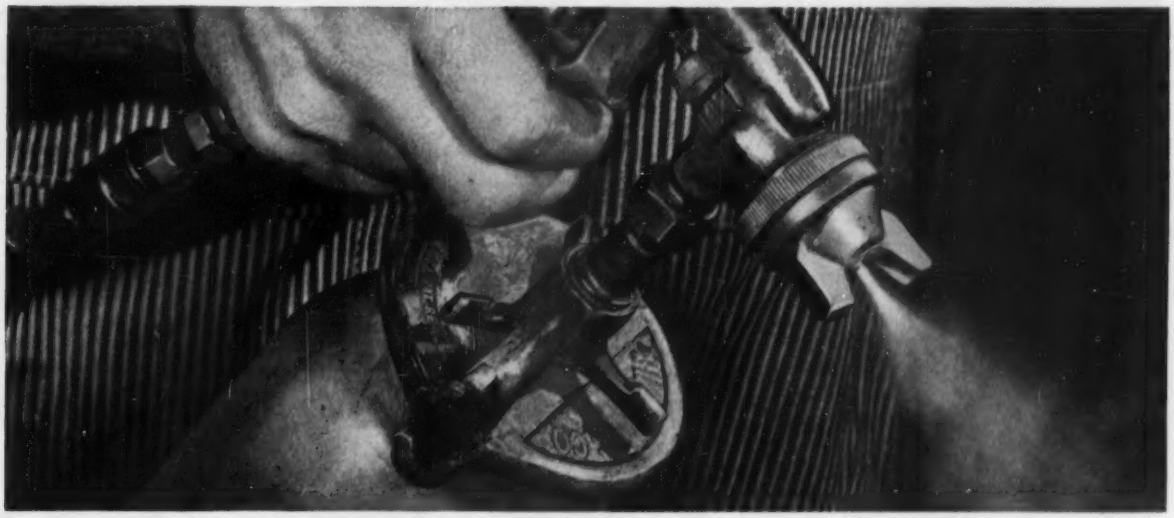
Magnesium nitrate: J. T. Baker Chemical Co., Phillipsburg, N. J., has expanded facilities for large tonnage manufacture of magnesium nitrate in technical, purified and reagent grades.

Nylon resin: Du Pont Co. of Canada is installing facilities for manufacture of nylon resin at its nylon yarn plant at Kingston, Ont.

Aluminum sulfate: Nichols Chemical Co., Ltd., Allied Chemical & Dye subsidiary, will complete an aluminum sulfate plant in Barnet, B. C., late in 1956.

Titanium: National Research Corp. has been awarded an Air Force contract for development of manufacturing methods and pilot production of titanium alloy castings. Using private funds, the company has already devised vacuum arc skull-melting furnaces which handle pure metal and alloys.

THE START with your PAINT REMOVER



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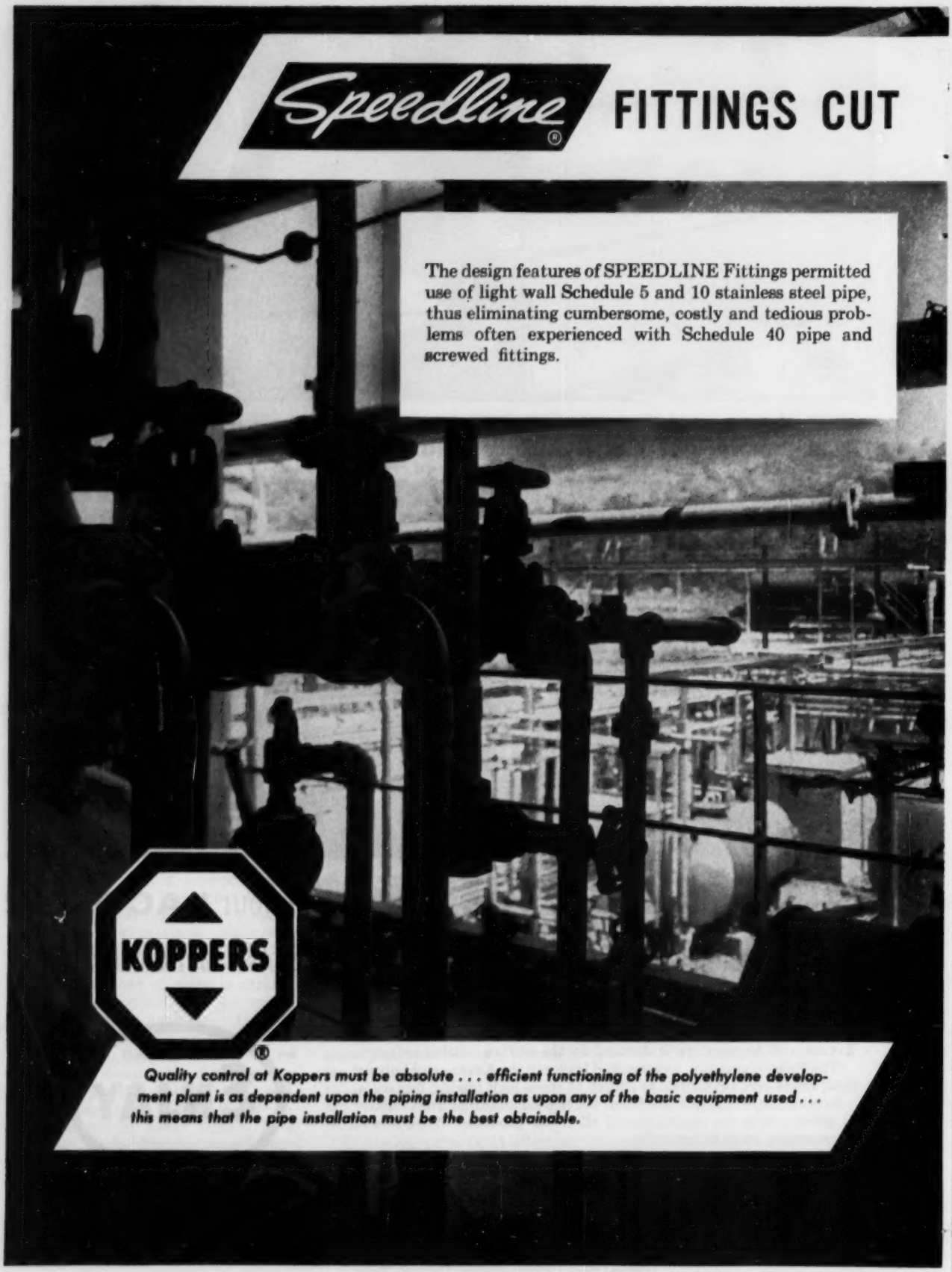
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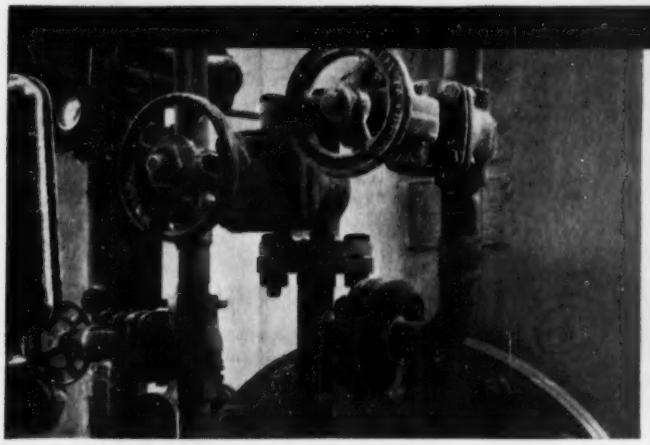
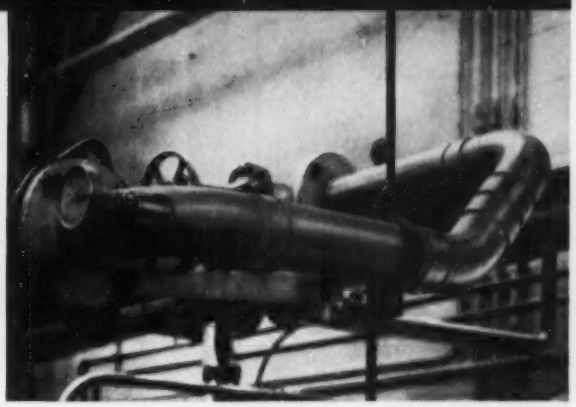
FITTINGS CUT
The design features of SPEEDLINE Fittings permitted use of light wall Schedule 5 and 10 stainless steel pipe, thus eliminating cumbersome, costly and tedious problems often experienced with Schedule 40 pipe and screwed fittings.
KOPPERS®
Quality control at Koppers must be absolute . . . efficient functioning of the polyethylene development plant is as dependent upon the piping installation as upon any of the basic equipment used . . . this means that the pipe installation must be the best obtainable.

INSTALLATION TIME 70% AT KOPPERS





70% Reduction in Installation Time

Plus Savings in Material Costs on Stainless Steel Process Lines

Manufacture of polyethylene demands a completely leak-proof, non-corrosive process piping system. Koppers Company knew that Schedule 40 stainless steel pipe with conventional threaded fittings could solve corrosion problems, but wanted to avoid costly leakage at joints in a new installation. "Back welding" to eliminate leakage would require additional installation time and labor—and result, at best, in a cumbersome, unsightly job.

So Koppers chose SPEEDLINE Fittings. Extensive tests proved to them that 100% protection against leakage could be accomplished with the use of SPEEDLINE Fittings and light wall pipe. Not only was leakage avoided, but installation time was reduced by 70%. In addition, material costs were considerably less than they would have been for pipe wall heavy enough to allow for loss of wall thickness at the threads.

SPEEDLINE's exclusive "tangential feature" provides the engineering advantages that simplify process pipeline assembly. The extra straight section on all formed fittings allows maximum clearance for welding or flanging assembly. The "tangential feature" also provides for direct attachment of SPEEDLINE Insert Flanges by simple expanding operation—allowing use of flanged connections wherever required. SPEEDLINE Aligning Connectors permit "in place" pre-assembly of pipeline prior to welding.

Once you investigate the use of SPEEDLINE Stainless Steel Fittings and low cost, light wall pipe for your particular process lines, you'll discover bonus advantages right down the line. An illustrated brochure describes in detail how a SPEEDLINE system can determine efficient process operations at your plant. Write for a copy without obligation . . . or contact the SPEEDLINE distributor nearest you.

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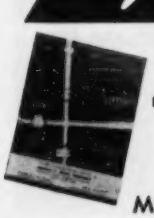

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1,200 F. FLAMES . . .

STOPPED in their course as . . .

Plastic Panel Wins Insurance Approval

Fibrous glass-reinforced plastic okayed as fire-retardant material for industrial construction.

Score two hits for Fire-Snuf fibrous glass-reinforced plastic paneling. For, in addition to its approval by Underwriters' Laboratories (1955), it has just been approved by Factory Mutual Laboratories as fire retardant. Thus it becomes the first structural plastic to carry both seals—the former, based on tests for fire hazard to occupants; the latter, on tests for physical damage to buildings.

Factory Mutual's seal of approval is the result of large-scale fire tests conducted at its labs in Norwood, Mass.—tests in which Fire-Snuf roof decks were subjected to flames with maximum intensity of 1,200 F. Under these conditions the plastic, though combustible under direct flame, was found to resist flame transmission.

According to the manufacturer, the fire-retardant qualities of its product are a result of carefully controlled processing of Hetron, a special type of fire-resistant polyester resin (developed by Hooker Electrochemical Co.) incorporated in the panel.

Factory Mutual's report is said to come at a time when industrial use of fiberglass-plastic corrugated panels and flat panes show a sharp rise—due to the material's shatterproof and light-diffusing properties, ease of integration with other structural materials, negligible maintenance cost. And now, the availability of a completely tested and proved fire-retardant plastic panel is expected to increase, even further, mounting use of this material.—**Resolite Corp., Zelienople, Pa.** 142A

Arsonosiloxanes

Combine properties of silicones and arsenicals.

A wedding of organic chlorosiloxanes and organic arsonic acids (to incorporate arsenic into the siloxane structure) has given rise to a new series of compounds possessing characteristics of both parents.

Known as arsonosiloxanes, the compounds are, like silicones, water repellent; like arsenicals, fungicides and pesticides.

Though their newness hasn't permitted thorough investigation of specific uses, it's expected that arsonosiloxanes might well be used in damp locations or humid atmospheres to protect materials (e.g., electrical insulations, canvas enclosures, leather products) from deterioration due to moisture and insect attack.—**American Smelting and Refining Co., New York 5, N. Y.; E. F. Houghton & Co., Philadelphia 33, Pa.** 142B

Polymeric Plasticizer

Combines permanence properties with low color.

A new primary polymeric plasticizer for PVC compounders is characterized by a unique combination of permanence properties coupled with ease of processing into vinyl compounds and low color.

Here are some of the manufacturer's claims for NP-10, a neopentyl-glycol-derived ester:

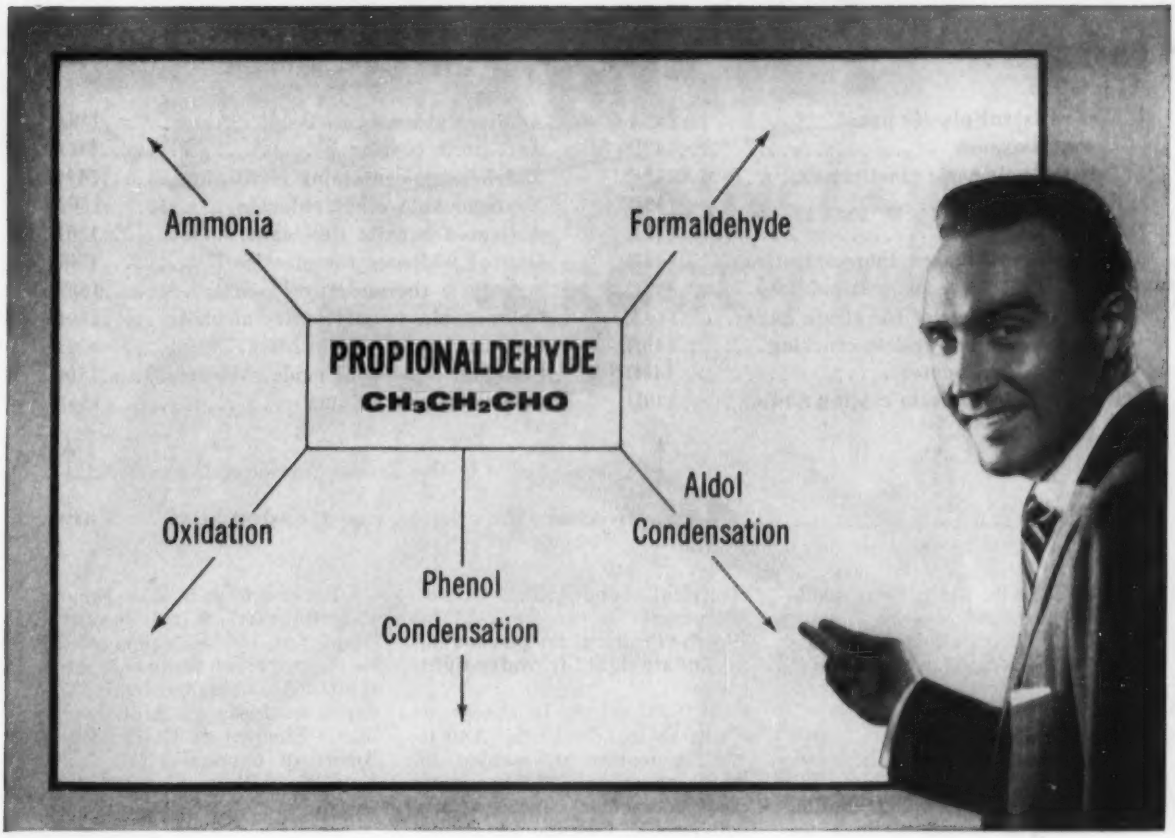
- Primary plasticizer—Offers outstanding permanence properties without addition of other modifying plasticizers.
- Permanence—Resists hydrolysis, remains unaffected by moisture under most severe outdoor weathering conditions. Loss from vinyl films to heptane, soapy water, activated charcoal is extremely low, insuring complete plasticization throughout the plastic's life. Shows little tendency to migrate to materials with which vinyl formulations might come in contact.
- Low color—Less than 100 ppm. (APHA).

In addition to the above, NP-10 produces films of excellent low-temperature flexibility, is easily handled. — **Eastman Chemical Products, Inc., New York 16, N. Y.** 142C

Solar-Cell Silicon

Special grade suitable for use in solar converters.

A special grade of silicon for use in solar batteries which convert the sun's energy to electrical power is being offered by Du Pont at $180/lb. (compared



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These reaction products of propionaldehyde have already reached commercial importance—trimethylol ethane for alkyd and polyester resins; 2-methyl-1-pentanol for plasticizers; propionic acid for esters, salts, and cellulose ester molding powders; and propyl amines as rubber accelerators.

Other derivatives of propionaldehyde are intermediates for the manufacture of pharmaceuticals and lubricant additives.

Call or write now for a sample and complete information on propionaldehyde. In Canada: Carbide Chemicals Company, Division of Union Carbide Canada Limited, Montreal.

Newsworthy Chemicals this month

Fire-resistant plastic panel.....142A
Arsonosiloxanes 142B
Primary polymeric plasticizer.....142C
Solar-cell silicon 142D
Super-soft rubber 144A
Methylstyrene-based thermoplastics 144B
Antioxidant serves many products.....144C
Epoxy-rubber sealer for strain gages.....146A
Epoxy insulation resists cracking.....146B
Petroleum sulfonates 146C
Repair putty corrects casting flaws.....146D
Additive prevents rock-salt caking.....148A
Anti-static coating 148B
Molybdenum-containing fertilizers 148C
Nonflammable ethyl chloride.....150A
Activated bauxite desiccant.....150B
Optical whitener for plastics.....150C
Antistatic thermosetting plastic.....150D
Color-stable, reactive fatty alcohol.....150E
Universal appliance finish.....150F
Shipping containers made skid-proof.....150G
Green-toned aluminum 150H

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with $350/lb. for regular semiconductor grade).

While the new solar-cell grade is exceptionally pure, it doesn't need the extreme purity of semiconductor silicon used in electrical and electronic devices such as transistors. Hence, the lower price.

In an experimental operation in Georgia, telephone lines are being powered by converted solar energy. Extra power is drained off into storage batteries to run the line when the sun isn't shining.

Du Pont says it developed the new grade of silicon because of growing interest in converters. **—E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.** 142D

Super-Soft Rubber

Neoprene-based compound has Durometer rating of 5.

Neoprene serves as a base polymer in Roth Rubber Co.'s new super-soft, non-porous rubber compound, RRD-992.

This new rubber, having a softness characteristic of 5 Durometer, is believed to be the softest, solid rubber yet developed by the industry. It can be used at temperatures to 200 F., is a reasonably good electrical insulator, can be vulcanized or bonded to metal and other materials.

Roth engineers anticipate acceptance of RRD-992 in many industries including: chemical processing, food processing, metal fabricating, automotive, electrical and construction equipment. It can be used to absorb vibration, dampen sound, as an air-tight or water-tight gasket.

RRD-992 comes in sheets or strips up to 1-in. thick. And it can be molded or bonded to metal or other odd shapes to meet customer needs.**—Roth Rubber Co., Chicago 50, Ill.** 144A

Two New Thermoplastics

Methylstyrene-based molding compounds exhibit high heat resistance.

Introduction of Cymac 400 and Cymac 201, two injection molding compounds based on methylstyrene monomer, mark American Cyanamid's entry into the thermoplastics field.

• Cymac 400—First injection molding compound based on methylstyrene. Offers unusual heat resistance (shows no apparent distortion after repeated, extended immersion in boiling water) as well as all the desirable properties of polystyrene—excellent color, clarity, electrical properties. Possible applications include: radio cabinets, industrial battery cases, housewares, refrigerator parts, phonograph records, small appliance housings, hospital and medical apparatus.

• Cymac 201 — Based on methylstyrene-acrylonitrile copolymer. Offers better toughness, chemical and craze resistance than Cymac 400 plus excellent heat resistance, clarity, luster and wide color range. Potential markets include: electrical fan blades, communications equipment, radio cabinets, appliance housings, refrigerator parts, business machine housings.**—Plastics & Resins Div., American Cyanamid Co., New York 20, N. Y.** 144B

Antioxidant

Prevents oxidation in petroleum products, rubber, food, plastics.

As part of its plan to diversify into the field of chemical derivatives for industry, Catalin Corp. of America, under a license from Gulf Oil Corp., has started production of an antioxidant for use in such products as aircraft fuel, white sidewall tires, food wrappers, pressure-sensitive tape, insecticides, etc.

An alkylated cresol, the new product is being offered in two grades, AC-1 (technical) and AC-3 (food).

• AC-1—Inhibits the formation of gums and peroxides in high-octane gasoline; prevents formation of sludge in motor and lube oils, development of odor or discoloration in waxes, decomposition and discoloration of rubber products; protects polystyrene, vinyl films and polyethylene from embrittlement and discoloration.

• AC-3—Minimizes rancidity of oily foods like candy and crackers, when used in boxes and wrappings.**—Catalin Corp. of America, New York, N. Y.** 144C

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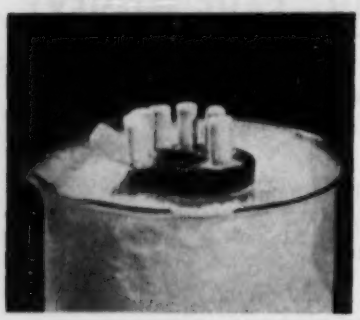
Epoxy-Rubber Sealer

Cuts production time for strain gages, improves reliability.

An epoxy-rubber alloy, Epoxylite 222, based on a combination of liquid epoxy resins with a liquid polysulfide synthetic rubber is now being used for environmental stress analysis in the aircraft and guided missile industries.

The sealer, both of whose components are solventless and can be mixed and cured at room temperature, is virtually impervious to water and moisture, develops excellent adhesion to a variety of surfaces—metals, vinyl, nylon, Teflon insulations used on connective wiring. Coatings provide sufficient mechanical strength to hold wiring in place. And vibration won't cause cracking or separation of wiring from the surface.

Epoxylite 222 is easily and simply applied. No heating of gages or test hardware is required and each application takes only a few seconds. Contrary to experience with other strain gage adhesives, it can be applied in the vertical as well as horizontal position. — **Epoxylite Corp., Montebello, Calif. 146A**



Epoxy Insulation

Withstands extreme temperatures without cracking.

Flexibility, through molecular modification rather than plasticizer addition, is the key to Scotchcast epoxy resin No. CRP 235's two outstanding properties —thermal and mechanical shock resistance.

• Thermal shock—At −50 C., aluminum pegs set in a rim of CRP 235 are so cold that they collect moisture (as frost), yet the resin remains unaffected (*see cut*). And when subjected to a thermal cycle of −70 to 150 C., samples of resin cast around a drilled steel cylinder show no sign of cracking.

• Mechanical shock—½-in. slabs of cured resin absorb maximum impact (46½ ft.-lb.) of the falling ball test, using a 4-in. steel ball.

Molecular modification of the resin is said to be made without sacrificing low viscosity (1,500-2,000 centipoise at 25 C., 60 centipoise at 140 C.), heat resistance, moisture resistance, adhesion to metals, electrical properties characteristic of epoxies.

CRP 235, used in production line casting of coils and other electrical components, has two companion products—Scotchcast No. CRP 241 (filled) and Scotchcast CRP 239 dipping resin. All three epoxies are packaged in 1-, 5- and 55-gallon containers.— **Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. 146B**

Petroleum Sulfonates

Recommended as emulsifiers, solubilizers, dispersers, rust preventives.

Four segregated petroleum sulfonates—one calcium, one barium, two sodium—have been added to Pennsylvania Refining Co.'s series of surface-active Petrosuls.

• Neutral calcium and barium Petrosuls—High molecular natural alkaline earth sulfonates. Used in rust preventives and fuel oil additive formulations.

• Alkosul 645—Sodium sulfonate product made from a synthetic alkylate feedstock. Used in rust preventives and additive formulations; also as a raw material for production of motor oil additives.

• Petrosul 645—Controlled blend of segregated natural petroleum sodium sulfonates having broad molecular weight distribution. It's useful in general sulfonate applications, particularly where overlapping properties like emulsibility and corrosion protection are needed or where a single sulfonate product is needed to function in different type formulations.—**Petroleum Sulfonate Dept., Pennsylvania Refining Co., Butler, Pa. 146C**

Repair Putty

Salvages machined castings by correcting surface flaws.

A headache often facing manufacturers using metal castings is discovering surface imperfections (e.g., sand or blow holes) uncovered by machining processes used during manufacture of the finished product.

Foundries are usually willing to replace rejects. But time and labor expended before imperfections are discovered must be borne by the manufacturer.

Now, with the availability of a new epoxy resin repair putty, Metalset A2, this primary production problem may at last have a solution.

For, unlike conventional repair procedures—depositing weld metal (expensive) or applying cold solder (shrinks on hardening)—Metalset A2 is inexpensive, cures at room temperature, doesn't shrink, machines perfectly to a surface identical to the casting, is easy to mix and apply.

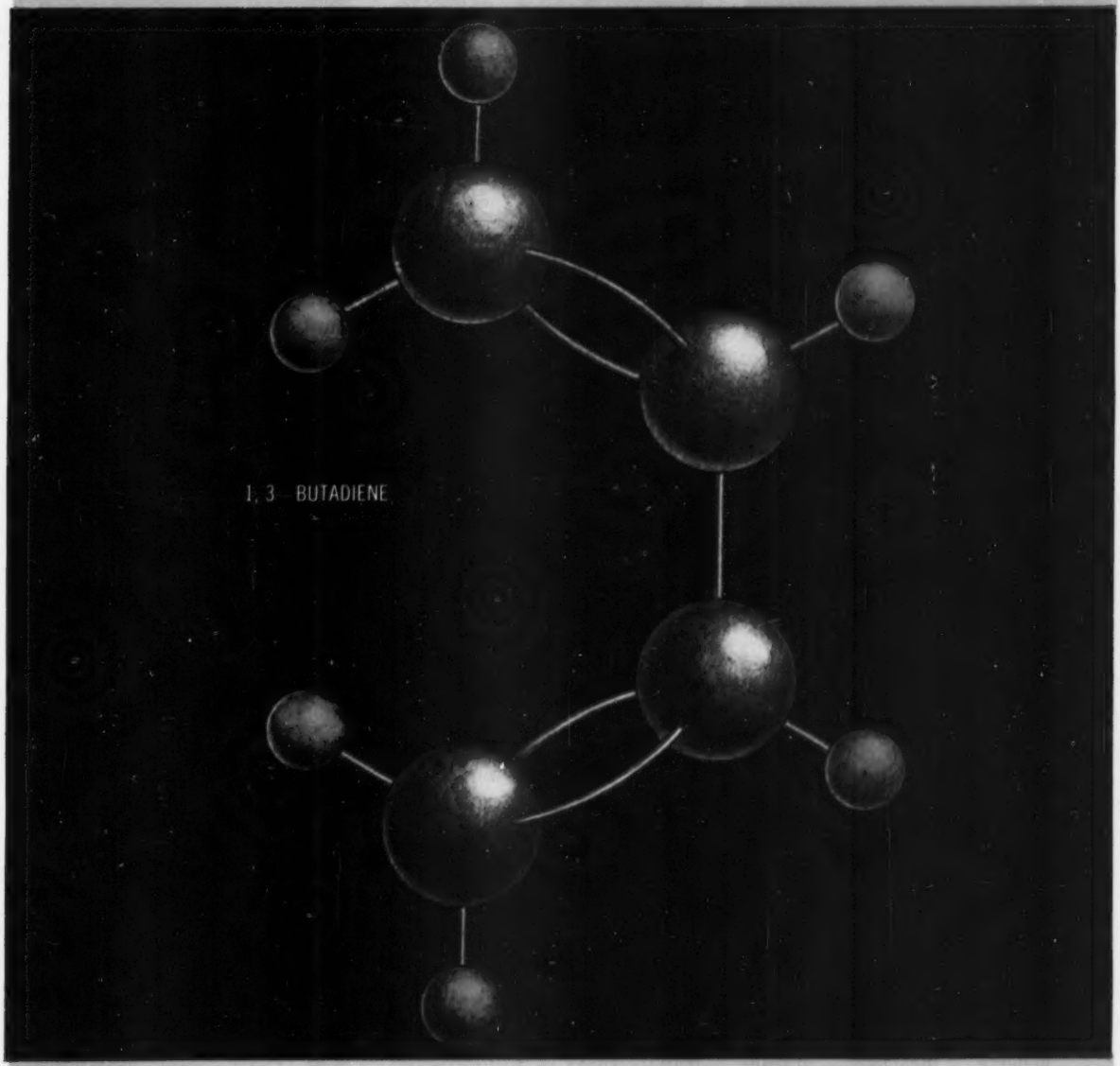
It's put to work as soon as a sufficient number of castings—found defective after machining —has accumulated.

Here's how it's used in repairing a defective casting for a 10-50 gpm. rotary pump: Metalset (in its original container) is mixed with 01 curing agent, then applied to the cleaned surface of the casting. After hardening at room temperature for several hours, it has a Rockwell Hardness value of M-70, compressive

EXPANDING THE BUTADIENE MOLECULE

Translated into action by American business initiative, infinite quantities of these molecules will be transformed into millions of tons of synthetic rubber. East, west, north and south, rubber-making capacity is rapidly on the increase.

Similarly the output of butadiene, an important source material, will grow substantially as new facilities come into production. Bechtel is taking an active part in this program . . . as designer, engineer and constructor.



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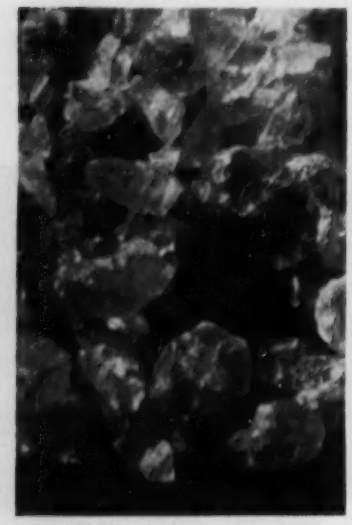
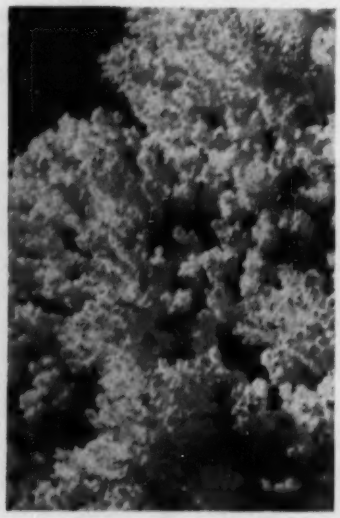
strength of 14,400 psi., tensile strength of 5,600 psi.

Once curing is complete, the casting is remachined by the original process—merely by putting it back into the production line.—**Smooth-On Manufacturing Co., Jersey City, N. J. 146D**



TREATED SALT develops . . .



MOSSY GROWTH which . . .

Prevents Rock Salt from Caking

Inorganic additive weakens crystalline bond between salt grains; prevents hardening, freezing.

For decades, rock salt used for melting ice and snow on highways has been caking in bulk storage and causing many handling and distribution problems to highway departments in ice-belt states.

But now, thanks to an efficient additive, Storite, years of expensive and tedious banging of the clogged rock-salt shaker are at an end.

Briefly, this is how Storite works: It alters or weakens the crystalline bond between salt grains, prevents caking and freezing.

But even more important, it:

- Eliminates need for expensive, inefficient storage facilities.
- Saves tax dollars by increasing the efficiency with which rock salt can be handled.
- Improves safety of winter roads by permitting speedy distribution of rock salt in the important first few minutes when storms strike or ice starts to form.

Storite is so potent that it's applied in a ratio of only 1:1,000 (i.e., 2 lb. Storite to 1 ton rock salt). For covered salt piles, it must be evenly distributed throughout the pile. For exposed, outdoor piles, only the surface of the pile need be protected.

Broad basic patents have been applied for on Storite. But until these are obtained, the new additive's chemical composition will be a closely guarded secret. All that the manufacturer is willing to divulge, at this writing, is that its product is a non-toxic, inorganic compound containing sodium ferrocyanide.—**International Salt Co., Inc., Scranton, Pa. 148A**

Anti-Static Coating

Teflon-based material developed for use on industrial equipment.

Gencote 108, a new anti-static coating based on Teflon, retains all of the latter's properties but one—electrical insulation. Instead, the new material is an electrical conductor, making it possible to produce an anti-stick, dry-lubricated, chemically inert surface which is also anti-static.

To date, 108 has found a number of practical applications:

- Chemical and drug cone blenders—Applied on the interior of these blenders, 108 prevents light powders from sticking to the side, assuring accuracy in mass-compounding of formulas.
- Conveying equipment — Anti-static property permits powders to flow freely, reducing costly cleanup time.
- Explosives handling — Eliminates accidental detonation by static discharge.
- High-speed cameras — Coated on the guide surfaces, 108 reduces friction between platens and film, eliminating static sparking.

When applied in a 4-mil film, Gencote's electrical resistance is about one ohm. Surfaces can be coated in multiples of ½ to 10 mils on any metal or material capable of withstanding baking temperatures of 700 F. Thus, electrically conductive surfaces can be applied over an insulating base such as glass, ceramics, porcelain. — **General Plastics Corp., Paterson, N. J. 148B**

Molybdenum Fertilizers

For starting plants and foliar spray applications on East Coast.

Three molybdenum-containing fertilizers—two soluble, one liquid—should prove a boon to East Coast areas containing molybdenum-deficient soils.

For all three provide the necessary molybdenum (equivalent of 0.088% molybdenum oxide) for fixation of nitrogen by legumes and for reduction of

You Can See that it is Low in Iron and Turbidity!

Add SOLVAY Flake Caustic Potash to water and note the clarity of the solution. You can actually *see* the extraordinary purity of SOLVAY's technical product. You can see that it's lowest in iron—lowest in turbidity. These outstanding properties clearly indicate easier processing, greater economy and higher quality finished products at lower unit cost.

PROVE IT TO YOURSELF. Write for a free sample. Put it to the test. Compare it with the brand you are now using. Prove to yourself that SOLVAY Flake Caustic Potash is the finest technical grade you can buy—anywhere. And, SOLVAY quality costs no more.

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Aluminum Chloride • Vinyl Chloride
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DB-10

nitrates to ammonia for protein building in both legumes and non-legumes.

• Nutri-Leaf 60 (soluble) is a 20-20-20 fertilizer containing all common trace elements in addition to molybdenum. It can be incorporated in insecticidal or fungicidal sprays or applied alone as a nutritional spray. It's also used in transplanting vegetables, plants, flowers, shrubs, trees.

• Liqua-Leaf, a 10-10-8 product is similarly enriched with secondary plant nutrients and applied as a spray on pasture and forage crops as well as on vegetables. It, too, can be incorporated in insecticidal sprays, can be used in transplanting.

• VHPF, (soluble) a 6-25-15 fertilizer, contains hormones plus trace elements. It's specially designed for transplanting, is high in phosphorus to stimulate heavy rooting.—**Miller Chemical & Fertilizer Corp., Baltimore, Md.** 148C

BRIEFS

Nonflammable ethyl chloride, known as Fluro-Ethyl, is a solution of C_2H_5Cl in dichlorotetrafluorethane. Because of its ability to produce rapid refrigeration and anesthesia of the skin, the solution is expected to find widespread use in "painless" intramuscular injections — such as those now being administered to children in the anti-polio Salk vaccine campaign. — **Gebauer Chemical Co., Cleveland, Ohio.** 150A

Low-cost, activated bauxite desiccant, Driocel S, has been specifically developed to overcome souring of LPG products during the final drying step. Its advantages include: improved drying and stabilizing; absence of souring reaction with sulfur compounds; no acid polymerization catalytic reaction toward heavy ends of liquefied gases. Initial commercial installations put on stream 30 months ago are reported still operating, indicating long desiccant service life.—**Minerals & Chemicals Corp. of America, Menlo Park, N. J.** 150B

Optical whitening agent geared for use in the plastics industry is claimed to combine excellent solubility in hydrocarbons, ketones and other organic solvents with unusual stability to both heat and light. Called Tinopal PCRP, the new whitener dissolves in plasticizers used in the manufacture of cellulose acetate and PVC plastics as well as in unplasticized materials like polyethylene and polystyrene. Tinopal is stable to 550 F. Only very small amounts are needed to offset slight yellowness of the base plastic — whether pigmented or clear and transparent.—**Geigy Co. Ltd., Manchester, England.** 150C

Antistatic thermosetting plastic, Homalite 141, resists accumulation of static electricity on its surface, thus making it ideal for sensitive instruments where static affects accuracy. Light weight and high scratch resistance of this strong, clear, heat-resistant plastic sheet also make it an excellent transparency where heat, fracture and chemical resistance problems are common.—**Homalite Corp., Wilmington 4, Del.** 150D

Color-stable fatty alcohol, Adol 32, is a straight-chain, unsaturated, monohydric alcohol (essentially oleyl) with low viscosity and high chemical reactivity. It's non-corrosive; soluble in a variety of solvents; miscible with fats, fatty acids, petroleum oils and waxes. Combination of properties makes it ideal as an emollient, super-fatting agent, compound for detergents. Other possible applications: chemical intermediates, surfactants, germicides, resins, textiles, lube oil additives, etc.—**Chemical Products Div., Archer-Daniels-Midland Co., Cleveland 2, Ohio.** 150E

Universal appliance finish, based on a new polymer and tentatively designated as MD enamel, is still months away from commercial production but is currently being tested on production finishing lines. Said to be the most durable coating ever made from organic materials for home appliances, MD is much harder than currently used enamels, more resistant to marring and chipping, unaffected by prolonged exposure to high-temperature soap solutions. —**E. I du Pont de Nemours & Co., Inc., Wilmington 98, Del.** 150F

Anti-skid coating called Resyn 32-3415 solves skidding problems of palletized, printed shipping containers (caused by slickness of new finishes). Applied, via spray nozzles, to bottoms of cases as they leave the case sealer, coating dries almost instantaneously in an invisible film which provides a non-skid surface. Thus, cases treated with 32-3415 may be handled by automatic palletizing equipment, shipped and stored without slipping from place.—**National Adhesives Div., National Starch Products Inc., New York 16, N. Y.** 150G

Green-toned aluminum industrial products, colored via chemical immersion treatment, are being offered by Alcoa in V-beam, ribbed, corrugated and flat flashing sheet. Latest addition to "architectural Alodine" line of finishes, new color treatment greatly increases aluminum's natural resistance to corrosion from salt spray and industrial fumes; makes roofing and siding treated with it ideal for power plants, manufacturing buildings, other industrial structures.—**Aluminum Co. of America, Pittsburgh 19, Pa.** 150H

For More Information...

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

now, Crucible low nickel stainless steels that meet many of your needs . . .

Here are two *new* Crucible grades, Rezistal type 201 and 202 that are similar in quality and properties to types 301 and 302 . . . but with desirable features all their own.

In the annealed condition, for example, Rezistal 201 and 202 have about 10% higher strength than 301 and 302, yet maintain almost identical ductility. This means that these grades can be fabricated with ease equal to their counterparts. In addition, their mill finishes and corrosion resistance to a wide variation of media compare most favorably with 301 and 302.

To sum up: Rezistal 201 and 202 have practically all the desirable properties of 301 and 302, *plus* some of their own. And they're available *promptly* in all forms. Write now for data sheets fully covering the properties of these new stainless grades. *Crucible Steel Company of America, Dept. ACE, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

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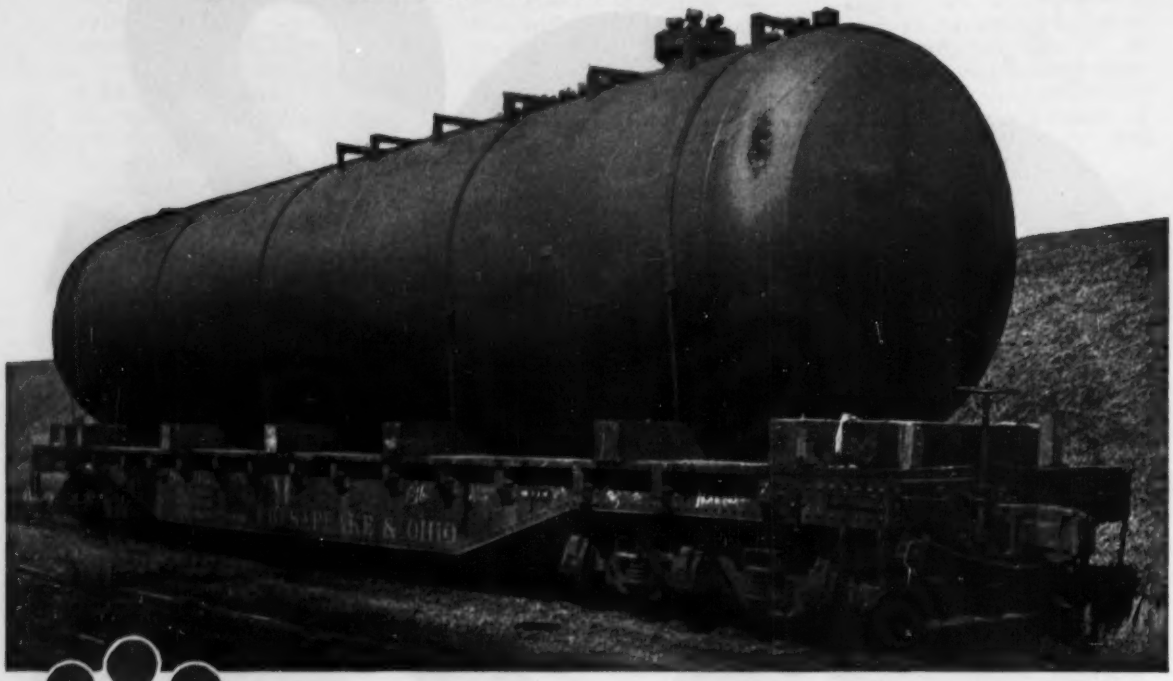
One of six 51-foot liquid chlorine horizontal storage tanks built and tested by Newport News to meet A.S.M.E. Code requirements. This pressure vessel was welded by Union melt machines. Pressure vessels undergo stress-relieving treatment in our ovens.



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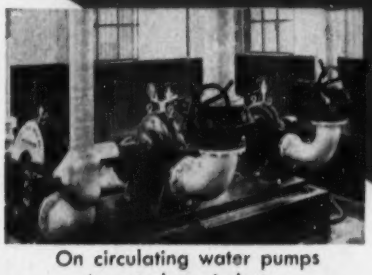
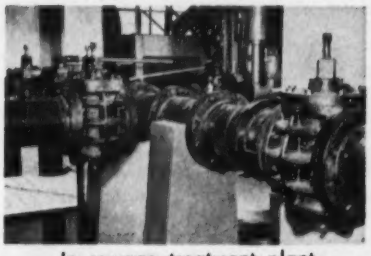
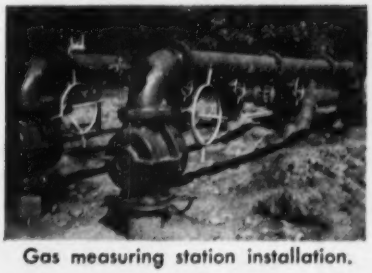


On circulating water pumps in petroleum industry.



In sewage treatment plant.



Gas measuring station installation.

This Teflon* Gasket is another example why QCf lubricated plug valves are your best buy in round or rectangular port valves.

It not only gives greater protection against head leakage, greatly reduces turning torque, and operates in temperature to 450°F, but it also prolongs service life . . . and that means a substantial saving in valve maintenance costs.

Many years of field testing, plus years of industry service, have proved the importance of this feature in QCf valve performance. See your QCf Representative and learn why it pays to specify QCf valves.

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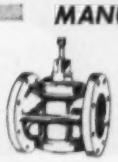


KEY RETURN BENDS AND FITTINGS

Sucaryl* granulated in this JEFFREY dryer is ready for tableting in a day, compared to a former two or three days

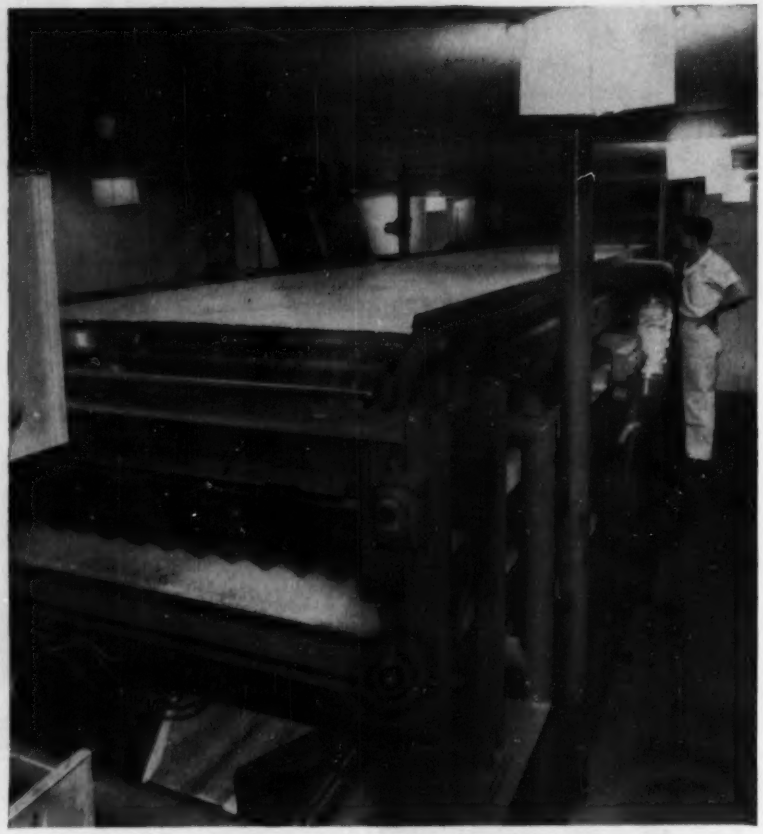
*Sucaryl is a non-caloric sweetener made by Abbott Laboratories of North Chicago, Illinois. It is available in tablets, powder or solution.

TRAY DRYING formerly employed in processing Sucaryl took two to three days. Even then, additional sizing of granules was required.

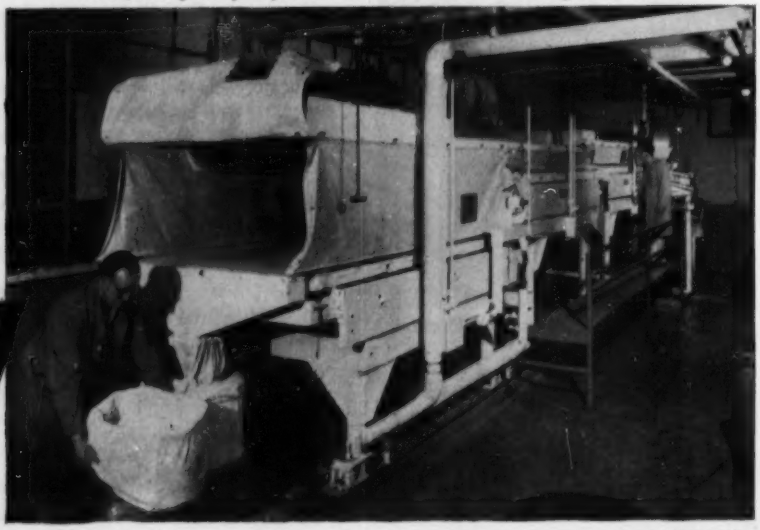
Today a triple-tier Jeffrey dryer completes a 2,000-pound lot of Sucaryl in a day, accurately blending and granulating it for the tablet makers.

These Jeffrey dryers gently convey material along on a solid plate conveyor surface which is heated from below. At the end of the first deck in each dryer, a granulator operates to give uniform sizing. Finish drying on particles thus sized is then completed.

Whatever your processing-conveying problem, Jeffrey vibration engineers can help you solve it. The Jeffrey Manufacturing Company, Columbus 16, Ohio.



Three-tier Jeffrey dryer of six sections dries tablet granulations.



Second Jeffrey dryer of three units in line prepares bulk powdered Sucaryl.

JEFFREY

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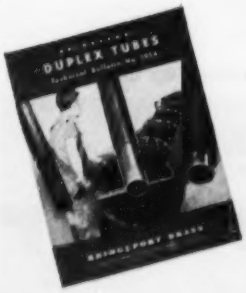
No pipe dream! Bridgeport Duplex Tube can help you lick dual corrosion conditions in more than 101 *different* ways! Duplex Tube matches one alloy against inside corrosion and another alloy against outside corrosion. More than 101 Duplex combinations are available. Each is designed to lick a particular combination of corrosive conditions.

Whatever your corrosion problem, get in touch with Bridgeport. Write for our questionnaire which has been especially prepared to aid you in describing your corrosion problem. Our Corrosion Laboratory will be glad to help you select the tube alloys that will serve you best.



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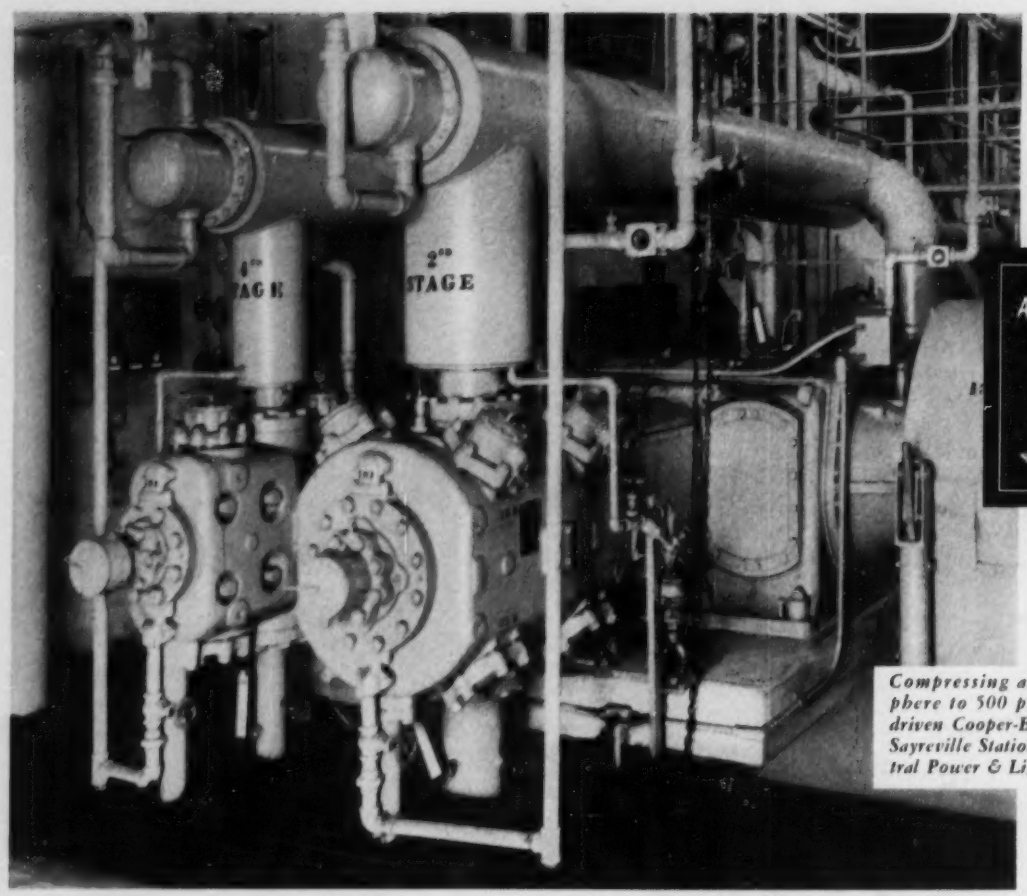
Dual corrosion and its prevention is discussed at length in Bridgeport's Duplex Tube Handbook. Write for your copy today.



Compressing air from atmosphere to 500 psig . . . motor-driven Cooper-Bessemers in the Sayreville Station of Jersey Central Power & Light.

How Cooper-Bessemer compressors cut trouble and cost in soot blowing service

• Here's an unusual example of flexibility and reliability in soot blowing operation. Three Cooper-Bessemer FM compressors, each rated 350 hp at 500 rpm, compressing air from 0 to 500 PSIG for the Sayreville Station of Jersey Central Power & Light Company, Sayreville, N. J.

Equipped with controls for 5-step automatic operation, these Cooper-Bessemer units assure maximum safety, permit minimum attention by operating personnel. Although compact in design, these compressors retain the accessibility feature so often lacking in similar type units.

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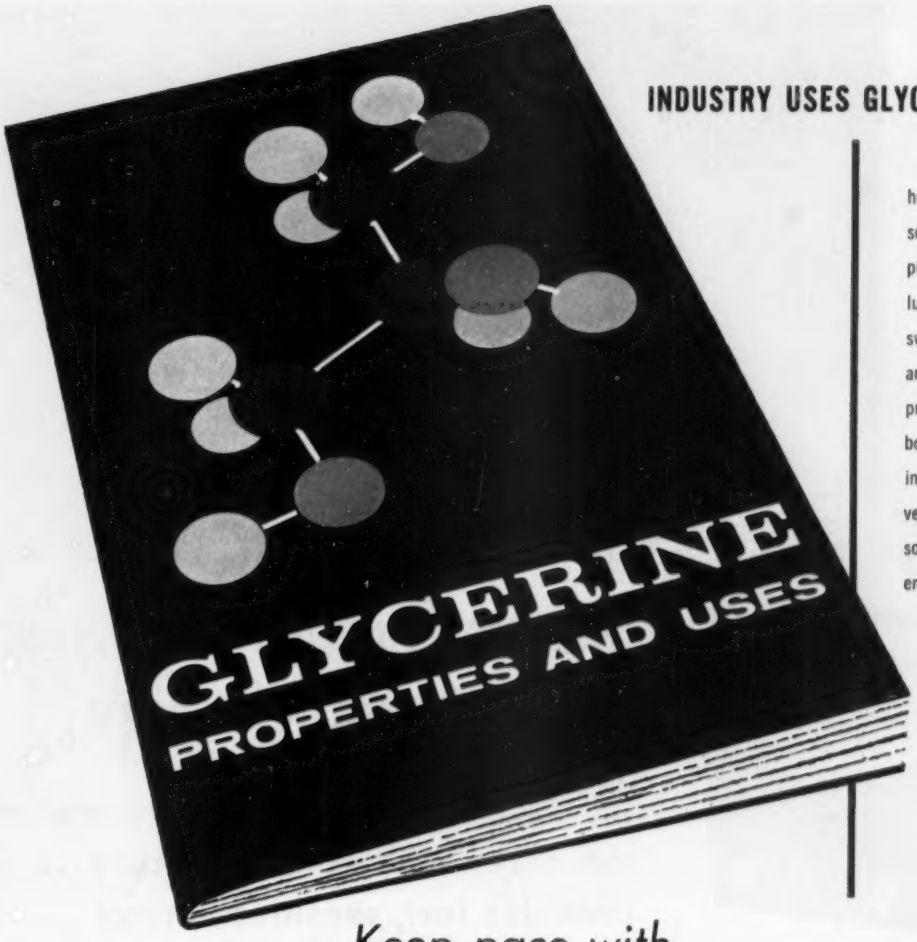

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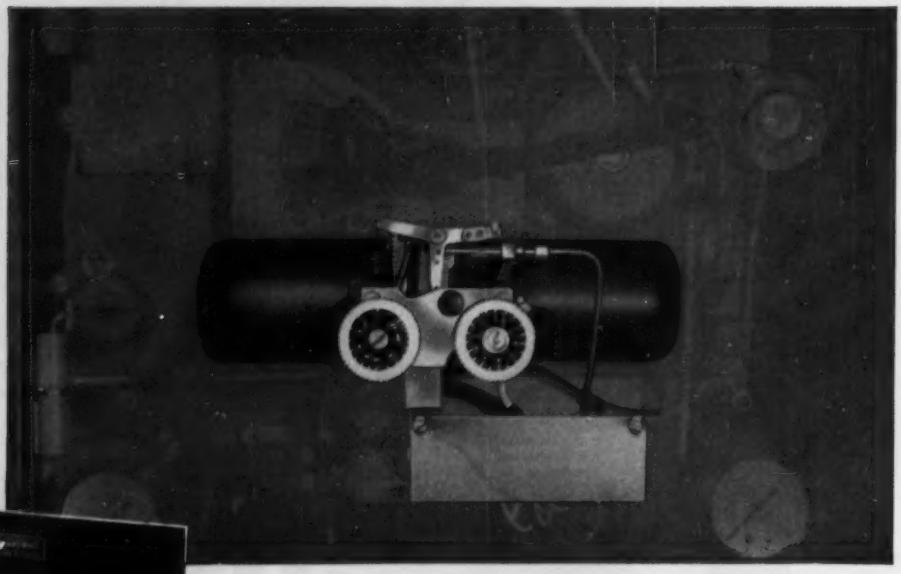

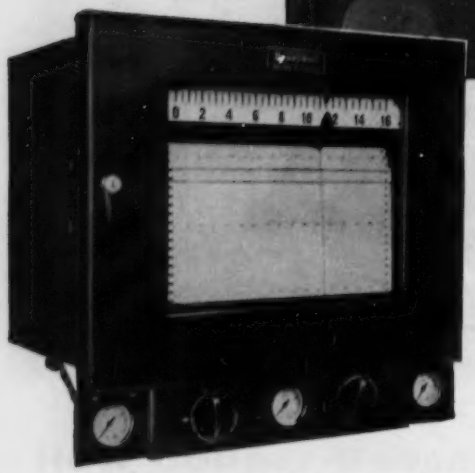

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ElectroniK Air-O-Line controller measures with ±0.2% accuracy... provides fast, sensitive control

If your process can't stand any offset, if you insist on reliable performance and hairline accuracy . . . this is the controller for you. Sensitive to changes as small as 3 parts in 10,000, this controller holds the measured process variable right where it belongs.

The *ElectroniK Air-O-Line* controller measures and controls temperature, pressure, flow, pH —*any* variable that can be changed into an electrical signal. By standardizing on this controller for your most critical processes, you reduce your maintenance burden. The same components are used in both strip and circular chart models.

Maintenance? Hardly any with the *ElectroniK Air-O-Line* controller. Dirt, dust, and dampness are sealed out. Vibration won't affect operation. The three main components of the *ElectroniK* instrument—amplifier, converter, and balancing motor—can be easily replaced if necessary.

This controller has proved itself in thousands of tough applications. It's the product of pioneering experience in electronic instrumentation . . . made by the world's largest instrument manufacturer . . . backed by the world's largest instrument service organization.

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- Hermetically sealed converter
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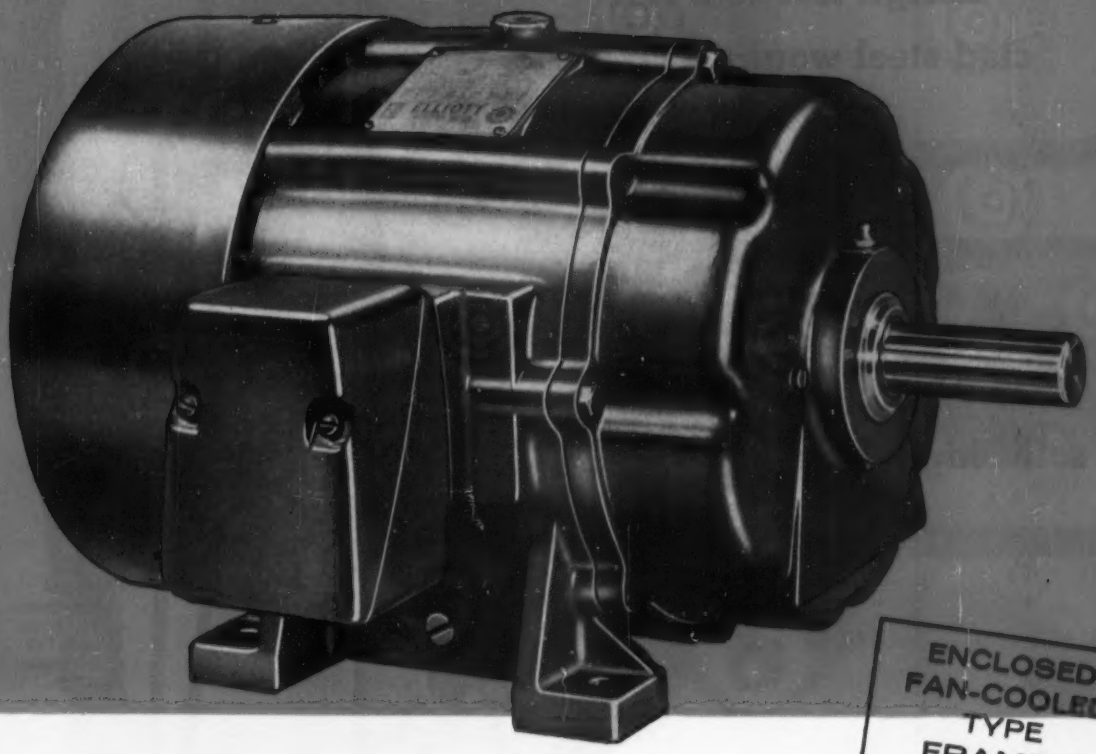
Inside and Outside . . . entirely new



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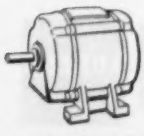
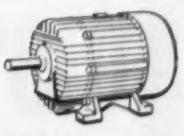


Totally-enclosed non-ventilated

Dripproof Protected



Totally-enclosed, fan-cooled (ribbed frame)

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CROCKER-WHEELER DIVISION

WRITE for new bulletin describing Elliott C-W Type N Motors. Address: Elliott Company, Crocker-Wheeler Division, Jeannette, Pa.

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...and it costs up to 50% less than solid high alloy!

Clad steel demonstration unit featured at Trade Fair of the Atomic Industry.

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■ Check price, lasting quality, easy adaptability. Check maintenance and daily performance. Compare clad steel with any other material for tanks, pressure vessels and other vital equipment. *From every angle, the difference spells economy!*

Why? Because clad steel delivers the benefits of solid high alloy—at savings up to 50% in material costs! Throughout the chemical and petrochemical industries, this economical material is paying off in top protection against corrosion, abrasion, product contamination.

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Only Lukens offers a selection of 16 cladding and 11 backing metals—giving you practically an unlimited choice of cladding and backing combinations to meet any conceivable need.

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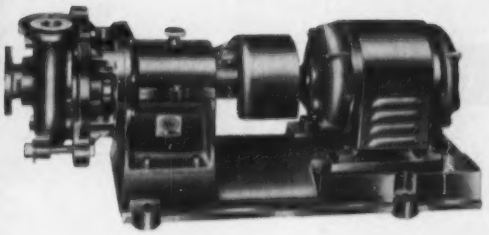

True pumping economy is a reality when you install Wilfley Acid Pumps. These rugged, heavy-duty pumps give you 24-hour, **trouble-free** operation. Production records **prove** that Wilfley provides the ultimate in pumping efficiency. Available with pumping parts of the machinable alloys as well as plastic to meet all requirements.

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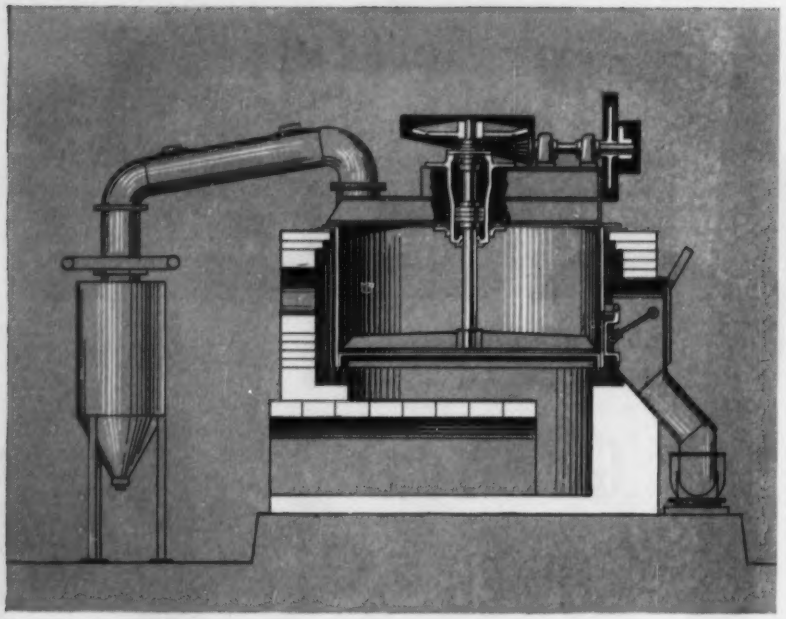
UNDER FIRED DRYERS *for* PROCESSING URANIUM PRECIPITATES *and a wide variety of other materials*



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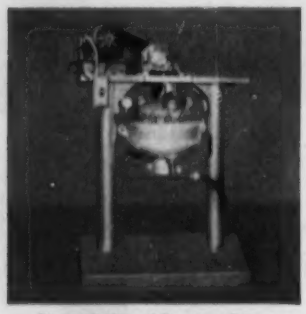

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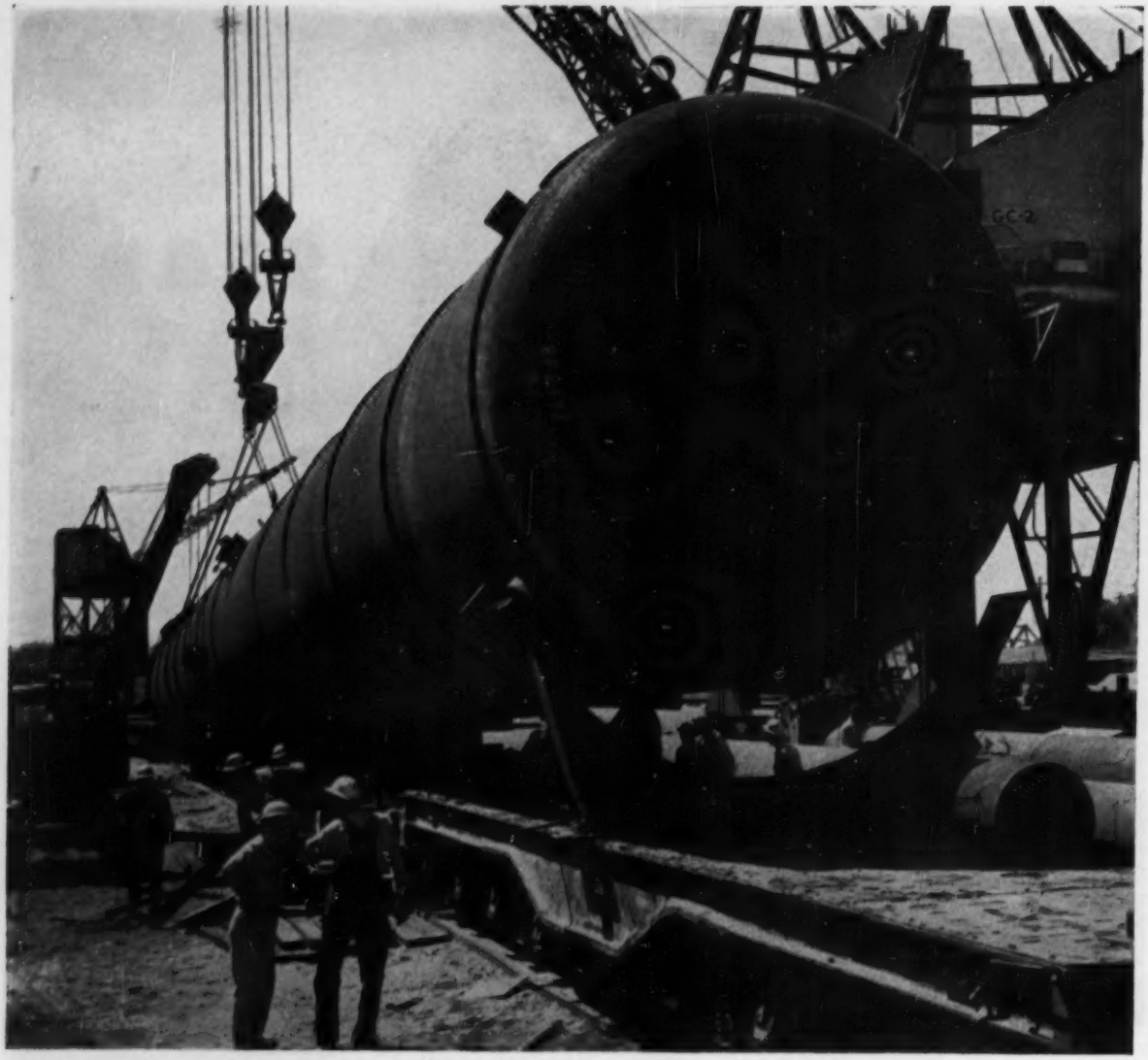

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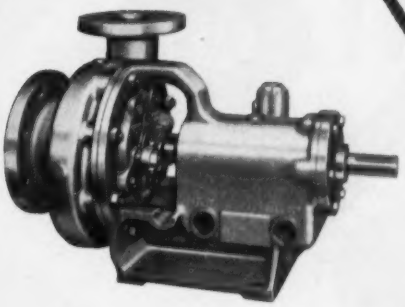

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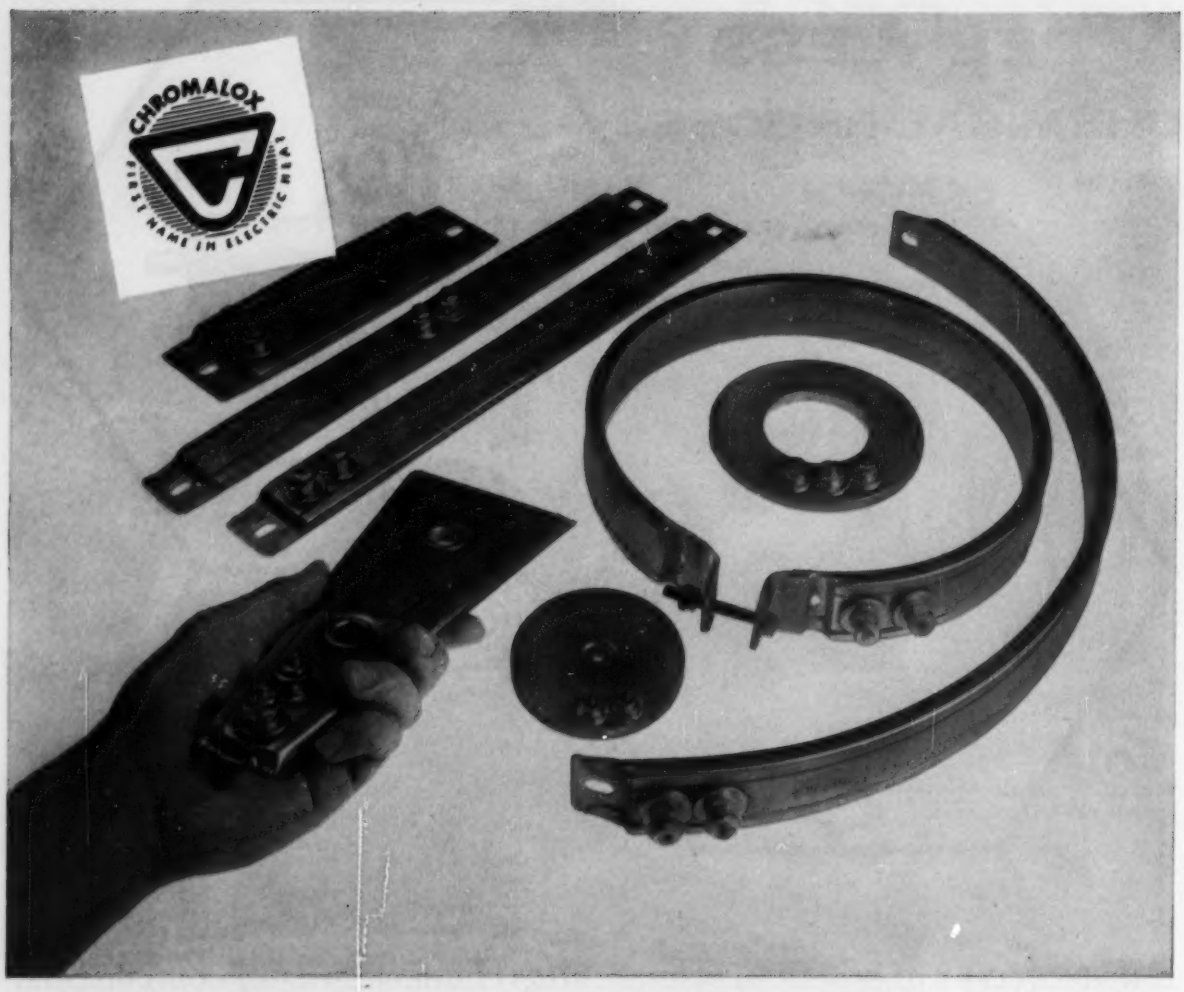

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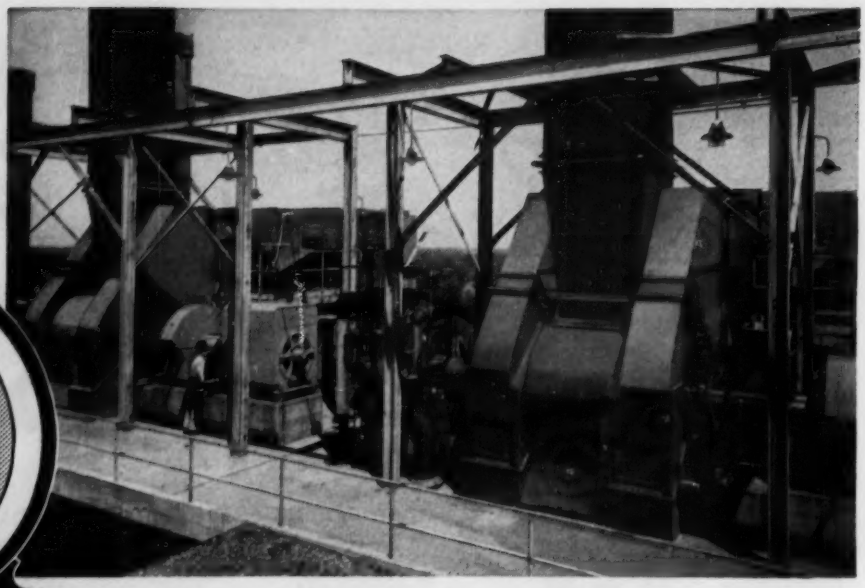

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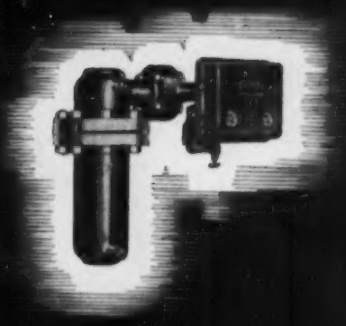

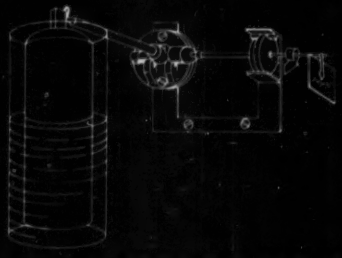

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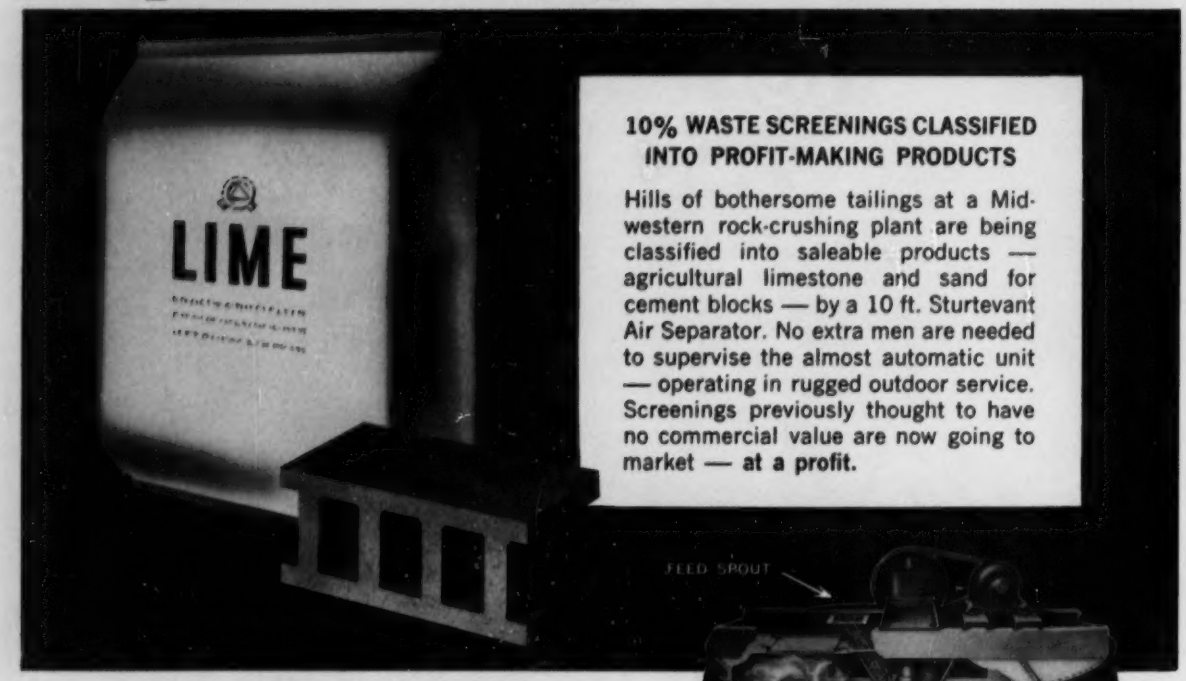
Tailings Go to Market - Separated by Sturtevant



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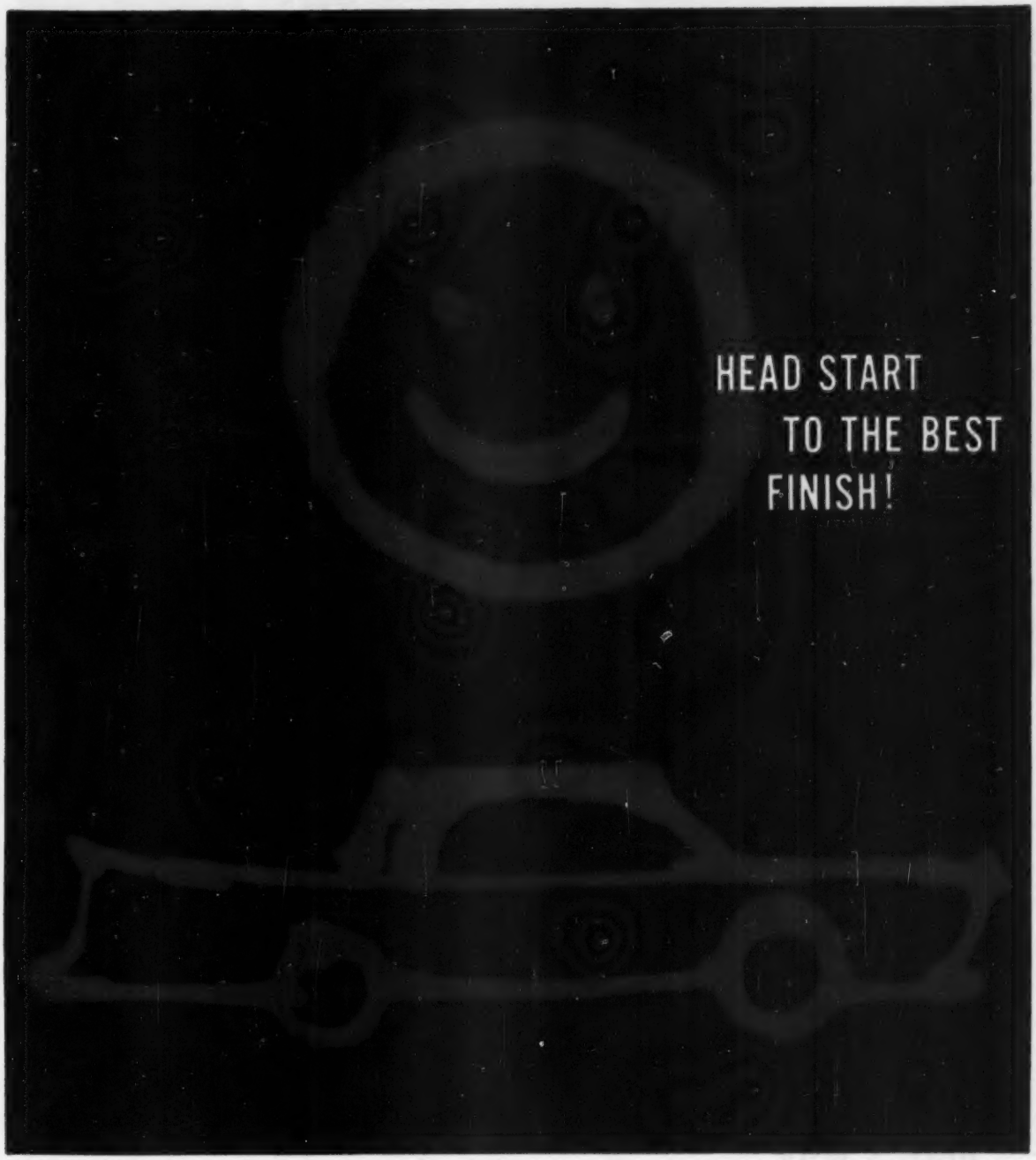

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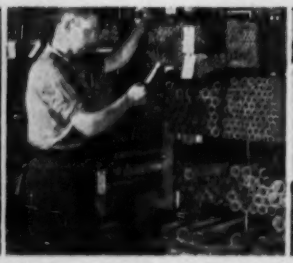

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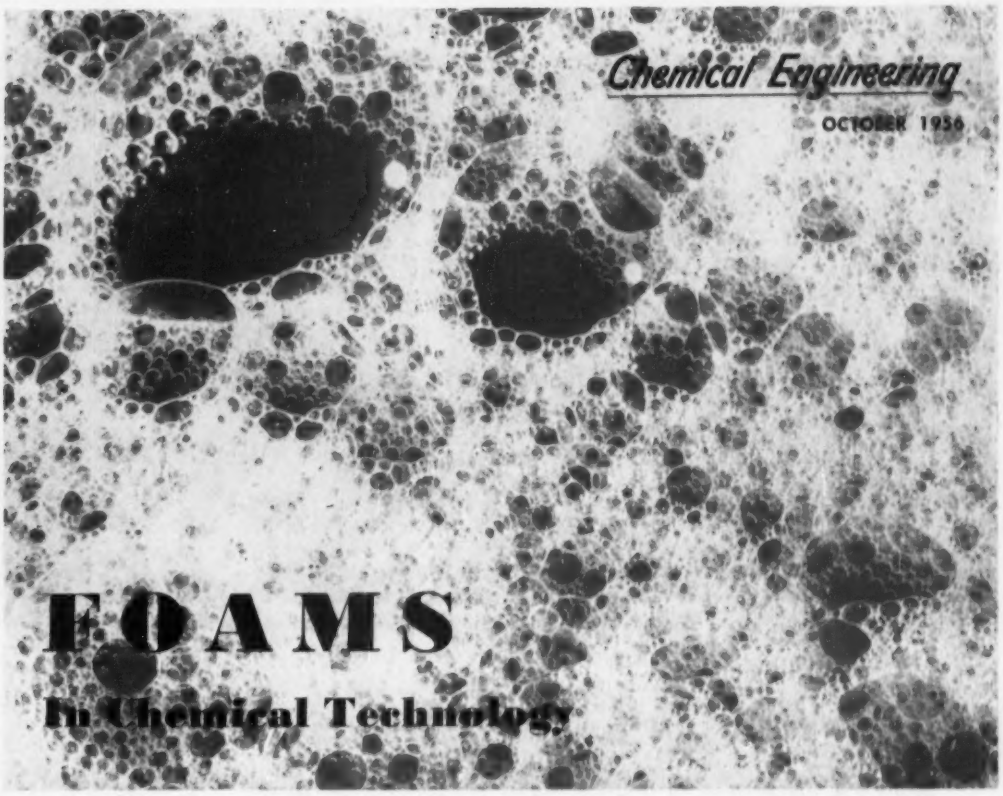


. . . What foams are and how they behave.

. . . How to eliminate troublesome foams.

. . . How to put useful foams to work.

ELMER L. GADEN, Jr., and VICTOR KEVORKIAN,*
Columbia University, New York, N. Y.

FOAMS, in one form or another, are frequently encountered in chemical technology. Sometimes they are beneficial but more often than not their presence heralds difficulties in process and equipment operation. As a result the great bulk of foam study has been devoted either to preventing their formation or destroying them once formed.

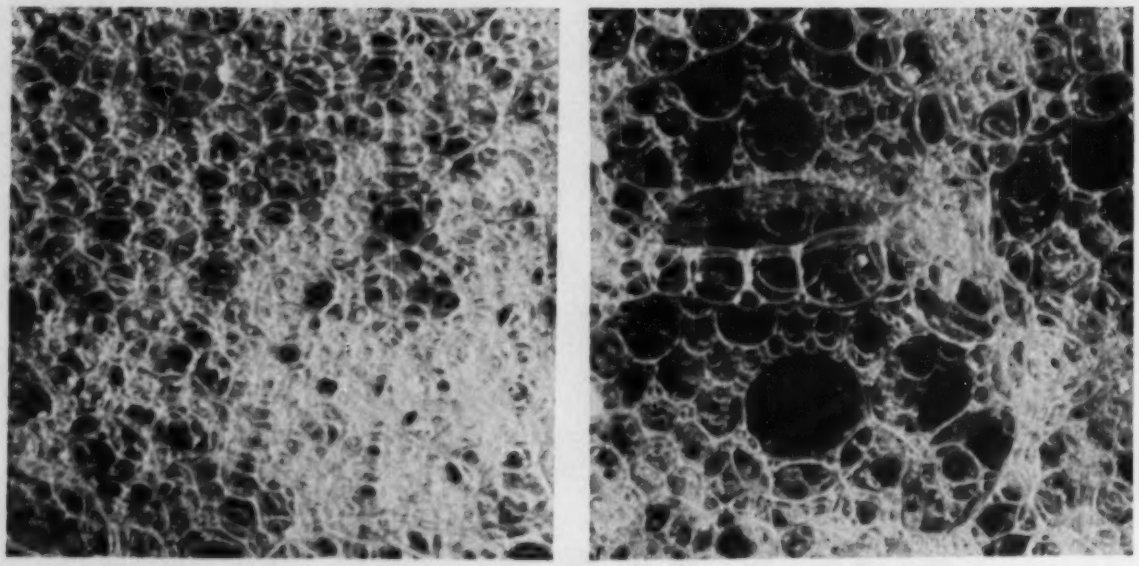
Recently, however, interest in the more useful aspects of foams has been on the rise. One of the best examples is the relatively new foamed plastics, offering unique combinations of properties never previously available in one material. Foaming agents for producing fire-fighting foams from water have long been of major interest. Another promising possibility is the use of foam separation processes.

Froth flotation—for the separation of mineral ores from gangue—is an old tale. A newer application is the fractionation of homogeneous solutions and colloidal suspensions, particularly those containing complex, heat-labile molecules. This technique can supplement the present tools available for separation and recovery in a chronic weak spot.

Perhaps because they occur so commonly in many of our everyday activities, foams have been given little close attention. Familiarity may not have bred contempt but it certainly has promoted indifference. It may truly be said that everyone knows a little about foams but few bother to know very much. Fortunately, the "few" have provided a solid background of physical chemical study on which we can lean in our examination of technological problems and promises.

The purpose of this report, then, is to give the chemical engineer a closer look at foams than he may have taken previously. An examination of their properties and characteristics provides a better basis for eliminating them when they are a headache—and controlling them when they are useful.

* Meet your authors on page 284.



CONTRAST in foams, showing fine to coarse. Foams in practice cover the entire range. (Fig. 1)

What Foams Are, How They Behave

Being gas dispersions in liquids, foams are affected by liquid properties such as surface tension, viscosity, concentration.

With very little difficulty we can see—and note the differences between—a great number of foams. Some, like the head on beer, are rather uniform and lasting; others, like the sea-foam produced by breaking surf, are composed of a wide range of bubble sizes and are rather short-lived.

Whatever their particular characteristics, all foams have an essentially identical structure, a honeycombed arrangement of gas bubbles separated by thin liquid walls. As such, foam is a dispersion of gas in liquid. It differs from the more common dispersions of gas in liquid in that the distances between individual bubbles are extremely small.

Stated differently, the volume ratio of gas to liquid is very great and the bulk density of the foam system approaches that of a gas rather than a liquid.

A foam may form whenever a gas is dispersed in an impure liquid. Pure liquids do not foam; saturated solutions rarely do. There are exceptions to this generalization, of course, but it is usually the case.

Perhaps the shades of meaning inherent in the terms "foam" and "froth" should be noted here. Many use either word and there is no real objection to this. Others reserve "foam" for stable, uniform dispersions like the "head" on beer. More transitory, unstable foams, like white caps on the waves, are referred to as froths.

Foam Properties

We have seen that pure liquids rarely foam to any degree when gassed. A second substance is needed in the liquid to produce a stable gas-in-liquid dispersion. This third component (in addition to the original liquid and gas) evidently produces a surface layer differing in composition from the bulk of the liquid phase. The surface layer so formed then acts as a "buffer," preventing the coalescence of gas bubbles dispersed in the liquid—particularly if it possesses reasonable mechanical strength.

In order to produce a surface composition different from the bulk of the solution, the additional component must either be positively adsorbed at, or rejected from (negative adsorption) the gas-liquid interface. The only quantitative measure of this behavior that we have is given by the Gibbs equation (see opposite page) and even this is of rather limited practical utility.

Forgetting quantitative aspects for the moment, the Gibbs relationship tells us that substances which reduce the surface tension of the solvent when dissolved in it will concentrate in the surface layers. Such substances are "surface active." Conversely, those substances which increase surface tension are "negatively" adsorbed and tend to concentrate in the bulk of the solution.

Foam Types

Qualitative differences between the foaming abilities of liquids and the types of foam produced are obvious. Some foams are very "rigid," and have a relatively low liquid content (high gas-liquid ratio). Others are very "fluid," having a wide distribution of bubble sizes and containing much entrained liquid (low gas-liquid ratio). Two typical foam structures are shown in Fig. 1.

"Drainage," or the run-off of the liquid between bubbles, is an important property of foams. It is most pronounced in the very "fluid" foams; less so in the "rigid" type. In addition to foam structure, drainage is dependent upon liquid viscosity and density. It is

an important consideration in foam separations.

As a rule the foaminess of aqueous solutions of inorganic compounds is small compared to solutions of alcohols, organic acids, bases, and esters.

Still more persistent froths are produced when aqueous solutions of colloidal materials like soaps, saponin, gelatin, etc., are foamed. These materials are all strongly adsorbed at the surface and, in addition, add mechanical strength to the films so formed. Saponin and the soluble proteins are particularly known for the rigid, stable foams which they can produce.

Finely divided solids will also help to stabilize foams. Evidently they contribute to the mechanical strength of the film by concentrating at the interface. An optimum particle size is usually found, those too large or too small being less effective foam stabilizers.

Probably the most important aspect of foams occurring in chemical applications is stability. Since foam formation is bound to be frequent in chemical operations, what factors govern the stability or persistence of foams that form?

Foam stability is affected by many properties of the gas-liquid system. Rarely is it dependent on one alone. In most practical cases that have been observed, foam persistence is the result of the interaction of several of these factors, including surface tension, viscosity, surface area, temperature, pH, and concentration.

Surface Tension

It is generally believed that, for a foam to be at all stable, the surface tension of the solution must be considerably less than that of the pure solvent. Low surface tension alone does not, however, ensure a stable foam.

The nature of the adsorbed layer is more important to foam stability than just a low surface tension. Gibbs, in his fundamental studies of foams, characterized foam stability in terms of a quantity he called "elasticity." It is defined by the relation:

$$E = 2A\left(\frac{d\gamma}{dA}\right)$$

Here A is the area of the liquid film and γ its surface tension. In other words "elasticity" is a measure of the change of surface tension which results in response to a change in area.

For a solution to produce stable liquid films—and hence stable foams—its surface tension must be readily variable and it must act always to oppose forces which distort the film.

Suppose we are dealing with a solution of a surface-active agent, one which reduces the solution surface tension and collects in the surface layers. If a film of this material surrounding a gas bubble is subjected to a shock (mechanical, thermal, etc.) which stretches the film, the concentration of surface-active substances in the outer layers must decrease, thereby increasing the surface tension of the film. This increased surface tension will counteract the forces extending the film, tending to restore the film to its original condition.

Conversely, if the film is contracted by some outside agency, the surface-active agent increases in concentration, decreasing the surface tension of the film which tends to extend the film again.

This characteristic, that is, the fact that the surface tension always acts to reduce strains in the films, is Gibbs' elasticity. A stable foam will then be one whose liquid films have surface tensions capable of fairly rapid local variations. Furthermore, to meet permanent differences in stress in its different parts, the film must be able to maintain differences in surface tension between these parts.

While low surface tension usually is indicative of a stable foam, the reverse is true for aqueous solu-

The Gibbs Equation: Heart of Foam Science

Surface adsorption, or preferential concentration of a third component at the gas-liquid interface, is the key to foam formation. It would therefore certainly be useful to have some quantitative expression of this phenomenon in terms of the properties of the solution being formed. The only one available is the Gibbs equation.

This relationship is of very limited use for engineering purposes, but it is the only one we have; hence a little closer examination of it is warranted.

Although a solution comprises but a single phase it is convenient to think of it as having two parts, (1) a surface layer surmounting (2) the solution bulk. The surface layer is of "molecular" depth and may, depending on the nature of the system, differ in composition from the interior of the solution. It is this difference that the Gibbs equation attempts to describe.

Gibbs formulated his adsorption equation directly from thermodynamic considerations. Experimental verification has never been completely achieved. It relates the equilibrium amount of any component adsorbed at the surface to the change in surface tension of the solution produced by that component.

In terms of activities (Gibbs used "chemical potentials") the surface adsorption of the solute in a binary solution at constant temperature is given by:

$$\Gamma = -\frac{a}{RT}\cdot\frac{d\gamma}{da}$$

where

Γ = Surface excess of the solute
a = Solute activity
T = Absolute temperature
γ = Surface tension of the solution.

The gas constant R is included in appropriate units. If the solution is ideal, or sufficiently dilute, solute concentration c may be substituted for activity:

$$\Gamma = -\frac{c}{RT}\cdot\frac{d\gamma}{dc}$$

"Surface excess" (Γ) of the solute refers to the difference in its concentration between the surface layer and the solution bulk. This, unfortunately, imposes a severe limitation on use of the Gibbs equation for any kind of design work. For such purposes, data are best expressed in concentration terms. To do this from the Gibbs relationship would require a knowledge of the thickness of the surface layer. This is unrealistic because the "surface layer" is not actually separate, the concentration profile from interface into the solution being continuous with no finite boundary between the two regions.

Probably the greatest value of the Gibbs equation lies in its qualitative description of what will happen when a solution is prepared. "Surface-active" solutes — i.e., those which lower the surface tension of a solvent—concentrate in the sur-

tions of certain surface-active agents. In these solutions the formation of micelles, and the resulting increase in surface tension of these stretched, oriented, thread-like molecular groups, can lead to extraordinary foam stability.

Viscosity

Some foam systems of very high surface tension are also very stable. In fact, lowering the surface tension may break the foam. This is clear evidence that foam stability depends on factors besides surface tension alone.

A foam is stable if the gas bubbles do not coalesce, but remain separated by thin liquid walls. If the viscosity of these liquid partitions is sufficiently high, foam persistence is enhanced. More viscous liquid films tend to absorb shocks better and also reduce the velocity of approach of bubbles. In fact, there is reasonable evidence that liquid viscosity—rather than surface tension—is the primary factor in foam stability.

Again, as in the case of surface tension, foam stability cannot be related to viscosity alone.

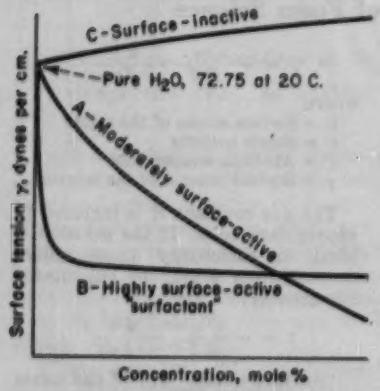
Surface Area

Liquid films of large surface area are less stable than those of small area. In general, the persistence of a bubble is greater the smaller it is; it falls off roughly in inverse proportion to the square of bubble diameter. As a general proposition, then, finer initial gas dispersions promote greater foam stability.

Temperature

The influence of temperature on the "foaminess" of solutions is complex. Foam persistence generally decreases with increasing temperature, probably owing to the combined effects of decreased viscosity in the liquid film and increased gas pressure within the bubbles.

One other aspect of the effect of temperature on foam stability must be reckoned with. If any component of the foam is significantly more volatile than the others, preferential evaporation will take place from the bubble films. Usually it is the solvent which is so affected, in which case the concentration of surface-active agent in the film is increased beyond the level determined by surface tension-con-



SURFACE TENSION varies with solution concentration. (Fig. 2)

face layer, since $d\gamma/dc$ (rate of change of surface tension with concentration) is negative.

"Surface-inactive" substances, for which $d\gamma/dc$ is positive, are desorbed (or negatively absorbed) and concentrate in the solution interior. The surface layer is then more dilute.

Surface tension-concentration relationships can then be used to predict the foam behavior of solutions. Curves of this sort for three different types of solutes are shown in Fig. 2.

Inorganic compounds are generally surface-inactive (curve *C*), and are desorbed, while organics are usually surface-active (curve *A*). Certain organics—the so-called surface-active agents or "surfactants"—are characterized by a marked reduction in surface tension over a very narrow concentration range. These comprise the third type (curve *B*) shown in Fig. 2. This potency is put to good use in detergency and similar applications.

Another way of stating the Gibbs adsorption theorem is to say that the concentration of the solute in the surface layer will always change in such a way as to decrease the surface tension. Thus, if further addition of the solute to the solution decreases the surface tension, it will be adsorbed and concentrate in the surface layer. If, on the other hand, continued solute addition increases the surface tension it will be negatively adsorbed and the surface layer will be more dilute than the interior of the solution.

During the almost 80 years which have elapsed since Gibbs laid the basis for study of adsorption at the gas-liquid interface, experimenters have tried to test his equation by various methods. Their efforts have, however, been mostly unsuccessful until recently, owing to the difficulty of measuring surface concentration.

The first attempt at verification made use of the rising bubble technique. Gas bubbles rise through the solution, become saturated with solute, and leave the solution as foam. Foam concentrations are then measured and compared to the residual (bulk). Adsorptions determined in this manner are usually much greater than predicted by the Gibbs equation.

The rising bubble situation does not represent the condition of true equilibrium to which the equation applies and it would be preferable to measure adsorption at static gas-liquid interfaces. Accordingly, a method was devised wherein a microtome blade is propelled across the surface of the solution contained in a trough, slicing off a very thin layer from the surface. Experiments of this sort give close agreement with the equation in most cases.

The most recent technique, which also gives data agreeing with the equation, employs radiotracers. An isotope emitting soft radiation (sulfur-35, carbon-14, calcium-45, etc.) is synthesized into the solute whose surface adsorption is to be measured. A detector of radioactivity placed over the surface of the solution is used to measure the radiation levels above the solutions.

For a surface-active compound (or surface-inactive) this will be greater (or less) than over the corresponding solution in which no surface adsorption takes place because radiation from the molecules at the surface is not absorbed by the solution. The fraction of the radiation emanating from the bulk of the solution is determined by making a similar radioactive measurement of a solution of the isotope synthesized into a compound which is not adsorbed.

centration effects. Such action then would weaken the film and cause local collapse.

Hydrogen-Ion Concentration

Relative acidity-alkalinity has little effect on foams except in the case of those produced with colloidal agents. These molecules can acquire electrical changes which affect their solubility and distribution in the liquid phase. Protein foams are generally most stable at the isoelectric pH, which is also the point of minimum solubility.

Concentration

Foam persistence is nil at either end of a "foaminess-concentration" curve (see Fig. 3). Neither pure liquids nor saturated solutions foam appreciably (detergents are an exception, their saturated solutions showing considerable foam persistence). Since the surface tension is approximately constant for both these cases, there is no surface adsorption, hence no concentration difference between film and bulk liquids.

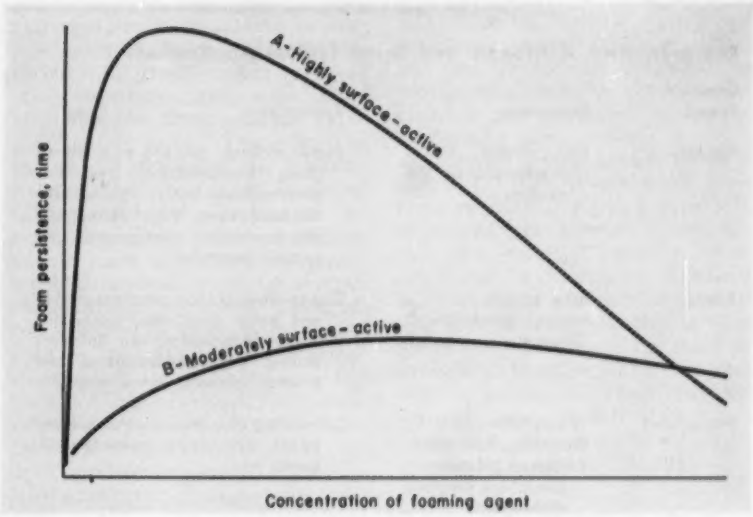
Furthermore, it is understandable that very dilute or nearly saturated solutions may not produce stable foams for neither possesses "elasticity;" their surface tensions are constant, or nearly so. Again, an exception exists for the highly surface-active agents like detergents.

It was long believed that pure solutions do foam, but such observations are generally traceable to the presence of tiny amounts of impurities (usually water) in a presumably pure liquid.

Lastly, it must be emphasized that the *ability* to foam, and foam *stability*, are quite different. The foam produced from a solution which possesses high foaming capacity is not necessarily stable. Ginger ale is an excellent example.

Foam Generation

Dispersions of gases in liquids for the production of foams may be brought about in either of two ways. First, a gas which is initially separate from the liquid is entrapped by spraying or agitating. "Sparging," or blowing a gas through a body of liquid, is certainly one of the simplest methods of foam generation. Most of the illustrations in this article use it.



FOAMINESS is a function of solution concentration. (Fig. 3)

Alternatively, dispersions may be produced when the gas is initially dissolved in the liquid. If combination (condensation) of the dissolved gas molecules occurs—either by heating the solution or by reducing the pressure—foam may form. This type of foam formation may also result from vaporization of one component of the liquid phase. Therefore, it is not even necessary to have a dissolved gas.

A third foam generation technique, which is really a variant of the one just noted, is the use of a "blowing agent." This is the method commonly employed in making foamed plastics. Some chemical agent, or mixture, which will decompose on heating or chemical activation, is added to the resin formulation. On decomposition a gas (nitrogen or carbon dioxide) is released which "blows" the plastic into a fine-bubble foam.

Eliminating Troublesome Foams

If foams can't be prevented, they can be destroyed by mechanical, thermal or chemical methods.

At the start of this report it was pointed out that a great part of the industrial study of foams has been concerned with their prevention and elimination. This reflects the difficulties which foaming can cause in chemical operations.

We have seen that foams can be produced whenever a gas is incorporated in a liquid. The same is true when vaporization is taking place. Boilers, evaporators, and distillation columns are prime examples of the latter. Reaction vessels, gas-liquid contactors, and stirred tanks in general are frequently troubled with foam buildup.

Probably the best chemical process example is the fermentation industry which counts foaming as one of its big problems. Here large batches of liquid medium containing surface-active substances, and usually finely divided solids as well, are sparged with great volumes of air. Foaming is rapid and generally persistent, since conditions are very favorable for foam production.

Other examples, though less obvious, are equally vexing.

Foam Destruction

A foam can be destroyed if its films are subjected to sufficiently great stresses. If the foam's

Representative Antifoams and Some Typical Applications

Chemical Type	Examples	Applications
Alcohols	Octyl alcohol High molecular-weight alcohols	Paper making; gelatine and animal glues; fermentations; dye and electroplating baths; aqueous distillations; soap manufacture; varnish production; photographic and ceramic industries.
Esters	Ethyl acetate Isoamyl isovalerate Glyceryl monostearate	Paper coating; food processing; glue and yeast production; waste disposal; evaporation; ore flotation; drilling muds; hydrocarbon and protein solutions; latex paints.
Phosphates	Tributyl phosphate Phosphoric acid esters Potassium trioctyl phosphate ethylene diphosphate	Lubricating oils; paper making; latex paints; detergents; mercerizing liquors; inks.
Polyamides	Polyalkylene polyamides Tetranaphthenoyl triethylene tetramine	Boiler feed waters
Silicones	Methylpolysiloxane fluids Methylsiloxane containing finely divided silica	Lubricating oils; vegetable and animal fats and oils; tar, asphalt, rubber and latex processing; paint varnish and lacquer production; fermentations; soaps and adhesives; paper making; leather and textile finishing; polishes and waxes; metal plating; resins.
Sulfates and sulfonates	Sulfonic acid salts Alkali metal salts of sulfonated alcohols	Petroleum production; paper making; hide and bone glues; yeast fermentations.

"elasticity" is unable to counteract these stresses, the resultant strains will cause rupture and breakdown of the foam structure.

In essence, methods of foam destruction are based on the reversal of those factors which contribute to foam stability. By reversing or inhibiting the natural stabilizing influences in the foam, it can be caused to collapse.

Foam control methods of reasonable utility employ mechanical, thermal, and chemical effects. In nearly every practical case, methods used involve more than one of these effects.

Direct Mechanical Methods

Any mechanical shock delivered to the bubble film can cause rupture. Depending on the severity of the stress produced and the film's resistance, foam failure may or may not occur. Common mechanical foam control methods include:

1. *Foam Breakers* — Blades or bars are used on rotating shafts (whipping), or grids and mesh in stationary apparatus. This may be called the "brute strength" approach and may be quite unsatisfactory.

For coarse, fluid foams of uneven structure simple beating operations of this type will frequently do a good job. If the foam is fine and rigid, however, beating may simply promote a reduction in bubble size, actually making the foam more stable.

2. *Sprays and Particles*—Foams may sometimes be destroyed by simply dropping solid particles or liquid droplets on them. The liquid drops may be taken from the foaming liquid itself and sprayed over the surface.

This technique again is best suited to coarse, fluid foams, and is frequently unreliable.

3. *Fluid Jets*—Jets of gas or liquid may be directed against the foam blanket. This method is particularly effective in many circumstances, even with rigid, stable foams. At least, there is much less possibility of stabilizing the foam than with the methods noted above.

4. *Pressure Changes*—Subjecting the bubbles of a foam to sudden changes in pressure will cause them to coalesce, become unstable, and burst. While this method is very effective, it is frequently impractical. In vaporization units (flash stills for example), however, it provides an inherent foam control system.

5. *Sonic Fields* — Essentially a variation of (4) above, sound waves of the proper frequency can collapse foam. The rapid succession of pressure waves cannot be matched by the foam's elasticity and rupture is very rapid.

Sirens, with a wide frequency range, or whistles tuned to a particular band, are employed.

Thermal Methods

Thermal stresses are also effective in causing the rupture of bubble films. They also enjoy the advantage of not promoting foam formation in any degree.

There are, however, other limitations which influence applicability of thermal stresses in a given case. Probably the most serious of these is that they are less direct, and therefore generally less effective on an energy input basis, then mechanical methods.

Thermal foam control involves heating (or cooling) the foam in some way—usually over a small area of the total foam blanket to promote local breakdown. This can be done with hot (or cold) gas jets, or by radiation from hot wires and bar heaters.

The effects are several, usually occurring together:

1. *Evaporation*—Heat will cause evaporation of volatile components (usually the solvent) in the bubble film, thinning and weakening it.

2. *Surface Tension*—Preferential evaporation changes the concentrations of surface-active agents in the foam and hence the surface tension. This may cause the foam to lose stability.

3. *Viscosity*—Viscosity decreases

with rising temperature and the bubble films are mechanically weakened.

Chemical Methods

"Antifoam agents" ("defoamers") constitute one of the most effective and widely used means of foam control.

They offer the advantage of rapid and reasonably lasting action with high specific activity—a little bit goes a long way. On the other hand they are relatively more expensive than mechanical and thermal methods and do represent a form of contamination of the process material.

Antifoam agents are themselves surface-active. Their specific feature is a very rapid decrease in surface tension with concentration (like the *B* curve of Fig. 3). When dropped or sprayed on to an existing stable foam, they cause extreme and rapid local variations in surface tension. Since their surface-activity is greater than that of other substances, they concentrate at bubble film interfaces and force the liquid away. The film, so thinned, is weakened and breaks.

Foam formation is, as discussed earlier, not just a matter of low surface tension alone. Antifoam agents must produce low surface tensions but cannot readily produce stable foams themselves. Chemical foam control is an essentially competitive process. The defoamer monopolizes the surface layer but does not support foam formation. In doing so it keeps away other surface-active agents which can produce persistent foams.

A summary of important antifoam agents and their recommended applications is presented in the accompanying tabulation.

Putting Foams to Work

Useful foams include those used for fire-fighting; foamed plastics; and foams for separating solids and some solutions.

We have seen some of the troubles caused by foams and some of the methods used to prevent or destroy them. Foams also have a number of beneficial roles in the chemical process industries. Unfortunately, these have generally received a much smaller share of attention. They include chemical fire control, foamed plastics, and foam separations.

Separation by foaming is certainly worth the chemical engineer's examination. It offers a technique which can well supplement present methods of separation and recovery. It will be dwelt on in some detail later. The other applications noted are less directly concerned with chemical engineering and will be only briefly mentioned here.

Fire-Fighting Foams

Foams offer an extremely effective means of fighting fires, particularly those involving liquids, a type often encountered in chemical operations.

The foam provides for oxygen elimination and temperature reduction through the action of one agency. Furthermore the ingredients for preparing foams and equipment for handling them are common to the normal materials encountered in chemical plants, offering some operating and maintenance conveniences.

Fire-fighting foams include both chemical and mechanical types. In all cases the stabilizer is the key, providing for persistence and effectiveness of the blanket. Chemical foams generally produce hydrated aluminum oxide which, in combination with an organic stabilizer of some type, provides a rigid, permanent foam. Mechanical types, or "air foams," need some foaming agent which is dissolved in the water base.

Foamed Plastics

Plastic foams ("expanded plastics") are a special case; once the resin has set the foam structure is permanent. A uniform, low-density material results, with excellent mechanical, thermal, and electrical properties, quite different from those of the unexpanded polymer.

In plastic foams the primary concern is even dispersion of foaming gas throughout the mass. As a result chemical blowing agents are commonly employed. These generate gas throughout the mass by means of a suitable reaction mechanism and produce the desired uniformity of structure.

Foaming agents include those in which (1) CO_2 is given off from some condensation reaction, (2) N_2 is evolved from thermal decomposition of a chemical additive (blowing agent) in the mix, or (3) steam is produced by a highly exothermic reaction. It is also possible to whip air or inert gases into the mass by agitation. In other cases air or a volatile solvent is forced into the polymer under pressure after which a reduction in pressure or increased temperature causes foaming.

Foam Separations

It is certainly not news to point out that fluid mixtures can be separated by foaming them. People have used this technique from time to time, particularly in the laboratory, but so far the only major commercial application is in mineral dressing for the separation of valuable material from gangue. The technology of froth flotation is well developed. However, it is not directly in the province of chemical engineering, and so will be treated only briefly here.

It is also quite possible to fractionate homogeneous solutions by foaming, an art which still awaits an industrial role. This should not be long in coming for it offers a technique particularly appropriate for separating mixtures which contain complex, non-volatile, and heat sensitive molecules.

More and more chemical process applications involve substances of this type. Mixtures of natural products, pharmaceuticals, polymers—even certain petroleum components—are particularly amenable to foam separation and this new approach will be described in more detail here.

Foam separation is at least qualitatively similar to other procedures such as distillation, extraction and adsorption. In these another phase is produced or introduced which will preferentially accumulate one or more components. If the foam is considered as another "phase" (perhaps "pseudo-phase" would be more accurate), the analogy is clear.

Photo by Bernard Hoffman. Courtesy of Hercules Powder Co.

ACTION of rosin amine derivative flotation agent shown by high-speed photo (about 1,000 × as reproduced). Particles to be floated have their surfaces modified by selective action of amine, attach to air bubbles, collect in froth. (Fig. 4)

Froth Flotation

Foam or, as mineral engineers prefer to call it, froth flotation, is widely employed for the separation of ore particles from gangue and debris. It is particularly useful for concentrating finely ground feeds which cannot be handled by hydraulic classification.

Froth flotation depends upon the action of chemical additives which modify the surfaces of one fraction of the particles and leave the others essentially unaltered. If the mixture is then foamed, the particles with altered surfaces attach themselves readily to rising air bubbles and collect in the foam or froth where they can be continuously skimmed away.

This action in froth flotation is shown photographically in Fig. 4. Here particles of sand, coated with a chemical collector (Hercules Rosin Amine D), are being lifted out of the mineral mass by air bubbles. Some bubbles are carrying only a few particles; others are covered with aggregate masses of the collector-coated silica.

A foam is needed in order to make the separation reasonably efficient. It would be possible to operate in such a way that particles were readily collected by rising bubbles but no foam would be formed. Under these conditions the bubbles bursting at the liquid surface would simply release their treasure to be stirred back into the bulk suspension. As we have seen, the foam provides another "phase" to which the collected material is transferred for separation.

Experimental examinations of froths in mineral flotation have shown not only enrichment of the foam with respect to the remaining liquid but also a continual increase in concentration of the collected mineral up through the foam layer.

This enrichment is due to drainage. The lower foam layers contain much more liquid in the separating films and it is here that the uncollected (reject) material is found. Higher foam layers have been longer removed from the liquid and are therefore better drained. The collected particles, however, adhere to the gas-liquid interface and are not lost as the intermediate liquid drains away.

This enriching action of a froth is shown schematically in Fig. 5.

In most cases the metallic mineral fraction is the one collected. But proper choice of chemical agents and operating conditions makes it possible also to remove non-metallic gangue and debris in the froth and recover ore in the underflow. The sand flotation operation shown in Fig. 4 is an example of this. Again, by manipulation of the system, different ores in a mixture can be concentrated.

Flotation Agents

Froth flotation requires two essential agents: (1) "frothers" to produce a foam of the right properties to act as a separating medium, and (2) "collectors" or "promoters" which selectively modify certain particle surfaces so that they may be collected by the bubbles. In addition, a variety of other chemicals is added on occasion to improve the action of particular frother-collector combinations.

Some collectors now available also produce considerable foam and, in a given instance, may not require the addition of a specific foaming agent.

Flotation Equipment

Two basic types of flotation units exist, as well as a host of modifications. Some of the main variations are diagrammed in Fig. 6.

The first of these, called bubble-column machines, comprise the bulk of currently used equipment. In these air is added to the liquid in the form of fine bubbles to which

particles attach. The methods of introducing air are manifold but the most common are (1) sparging (air agitation through a perforated surface) of the liquid-solid mixture ("pulp"), without mechanical agitation; (2) air agitation by air-lift action; (3) mechanical agitation with induction of air bubbles by means of a draft tube; and (4) mechanical agitation with air introduced under pressure either above or below the impeller. The first type has been largely displaced by the three later types.

Sketches (*a*) and (*b*) in Fig. 6 present the essentials of the sparged and air-lift types. Air, under pressure, is blown through some dispersion device like a perforated plate, canvas bag, etc., in Sketch (*a*). In the Sketch (*b*), air is blown downward, producing an upward air-lift action between a pair of baffles. In Sketch (*c*) air is drawn in through a draft tube and dispersed into fine bubbles by an agitator. If necessary, aeration may be increased by maintaining the draft tube under air pressure ("super-charging"); or, as in Sketch (*d*), compressed air may be admitted under the impeller. The agitator types offer a number of operating advantages and are widely used at present.

The second basic type of flotation unit is the "agitation-froth" machine, now largely displaced by the air-lift and sub-aeration machines. Here collection was effected by precipitating gas from solution directly onto the collector-modified solid surfaces. This was achieved by pressure differences from point to point in the mix caused by strong agitation.

Other Flotation Uses

While ore beneficiation is certainly the most important commercial flotation operation, flotation techniques are not limited to this. Whenever a suspension of fine solids is encountered, foaming offers a means of concentration. Whether it will be better or poorer than other applicable methods—like settling and filtration—can be determined only by the usual cost calculations.

If the mixture contains only one solid component, then foaming offers no advantage over conventional methods and can probably not compete. On the other hand, where the suspended material includes a variety of substances, of which only certain ones are to be recovered, the foaming technique becomes much more attractive.

Examples of foam concentration in other than mineral dressing applications are:

1. Clarification of liquids contaminated with finely divided solids—rayon spinning baths, for instance.
2. Separation of sludge particles in activated sludge waste treatment units.
3. Removal of grain and vegetable hulls in flour milling and canning.
4. Water purification.

Foam Fractionation

Foaming may be used to separate the components of a solution if one—or more—of them is surface-active. When such a liquid is foamed, these components will be preferentially adsorbed in the foam layer ("foam") and their concentration there will be greater than in either the residual liquid ("foamate") or the original solution. This is the essence of foam fractionation.

Foam fractionation is, as we have seen, particularly effective in separating mixtures containing complex, heat-sensitive, or chemically unstable molecules. In fact it has been applied mainly to natural biological materials, enzymes for example.

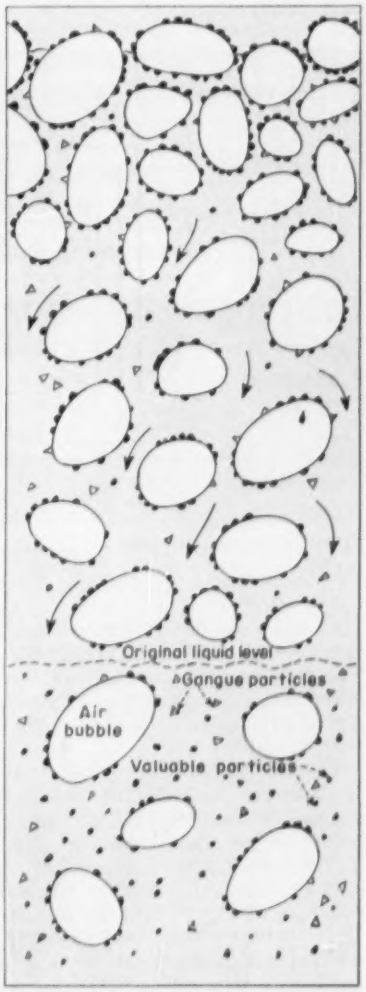
Probably the classic example of foam fractionation is the separation of an aqueous solution of two dyes, "Patent Blue" and "New Coccine." The blue dye is surface-active and concentrates in the foam; the red dye does not. A violet solution of the two dyes can be foamed, using nitrogen as the bubble former, to yield a blue foam and a red residual liquor.

A wide variety of materials has been separated or fractionated, including fats, fatty acids, and metal soaps prepared from fats, crude protein mixtures, and enzyme preparations. So far, however, no major commercial application has been put forward.

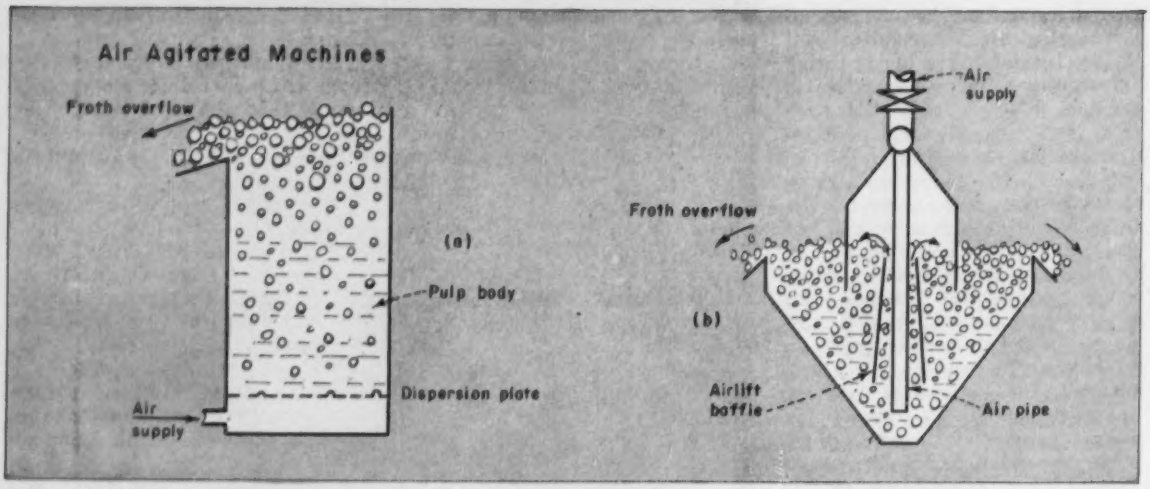
An important reason for this is the almost total lack of "process" and "engineering-design" data. This situation is rapidly being remedied so that foaming can be considered as a reasonable approach to the separation of liquid mixtures.

The fundamental property of a foam which commands our interest here is that when a liquid mixture is foamed, one component is preferentially adsorbed in the foam layer or "phase."

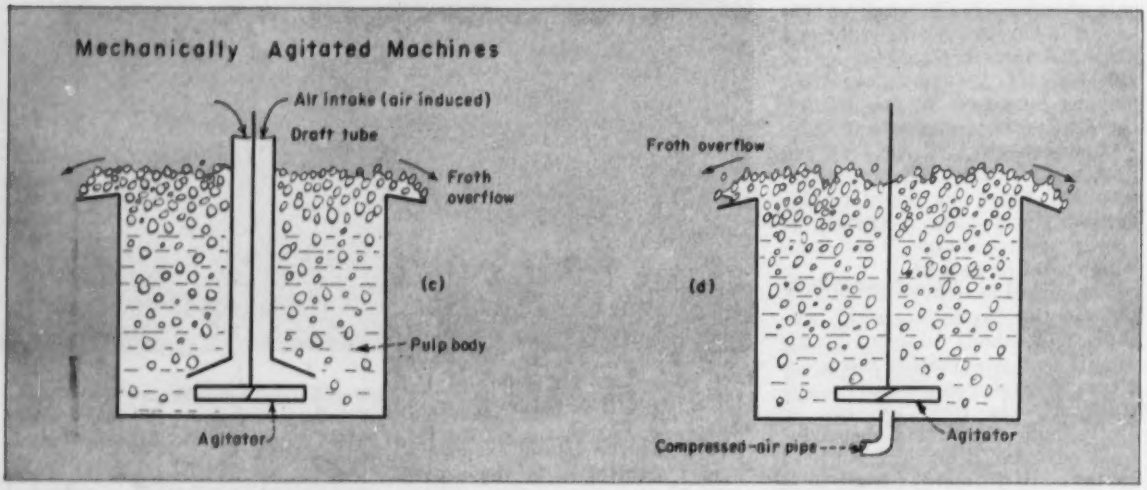
Once again Gibbs' adsorption equation offers the only quantitative measure of enrichment. But, once again, the relationship's utility for design purposes is severely limited by the way in which it was developed and expressed. The Gibbs equation applies only to a static liquid-gas interface in complete equilibrium with surrounding liquid and gas phases. A foam col-



FOAM ENRICHMENT occurs in flotation froth as result of drainage of liquid down out of foam. (Fig. 5)



FLOTATION MACHINES of air-agitated types, using porous medium at left, air-lift principle at right. (Figs. 6*a* and *b*)



FLOTATION MACHINES of mechanically agitated types, inducted air at left, supplied air at right. (Figs 6*c* and *d*)

umn does not satisfy this condition because of the constant enriching action of the rising bubbles. Nevertheless it can still be of great use in qualitatively predicting solution behavior.

Results typical of those obtained in foaming mixtures of isobutyl alcohol and water, using water-saturated air, are shown in Fig. 7, the solid curve. The alcohol is surface-active; its surface tension curve is of the *A* type in Fig. 2. It is therefore positively adsorbed and collects in the foam.

Foam fractionation data may be very conveniently presented in the "foam-foamate" type of plot illustrated in Fig. 7.

Foam Separation Methods

A foam fractionating device consists essentially of a vessel or column containing the solution to be foamed, and a receiving vessel. A gas (air, N_2, CO_2, etc.) is dispersed in the liquid and the resulting foam is collected. The liquid which results from the collapsed foam differs in concentration from the original and residual solutions.

A great many additional features can be added. Reflux of a sort can be provided by returning part of the collapsed foam to the foaming unit. Many people have used a recirculation type apparatus to obtain data on foam systems but this is pointless for an actual separation unit.

Fig. 8 shows a foam separation apparatus set up in the laboratory, and Fig. 9 a schematic flowsheet of a possible commercial design.

After the initial units for cleaning and compressing the gas (Fig. 9), the gas is saturated with solvent. This operation is optional, of course, depending on the value of the solvent and the concentration ("foam-foamate") relations expected in the system being processed.

As shown, the foaming column is set up for continuous operation but batches can be handled as well. Feed in this case is added directly

to the foaming vessel and little "stripping" action can be expected. Under these conditions, enrichment takes place primarily in the foam column. Reflux may be arranged as shown.

Finally a "foam-breaker," usually mechanical or thermal (see earlier section), is included to collapse the foam. Its action is comparable to that of a condenser. Solvent recovery from the exit gas may or may not be needed.

Although air is certainly the cheapest, other gases can be used in a foam separation unit. In cases where undesirable oxidation effects can result, the substitution of some chemically inert gas may be needed.

Multiple foam columns have been used in series, with the collapsed foam from the first column fed to the next in line where it is refoamed. This is analogous to the common arrangement of a number of batch stills in series. Cascade arrangements of foam columns have often been used.

Factors in Foam Fractionation

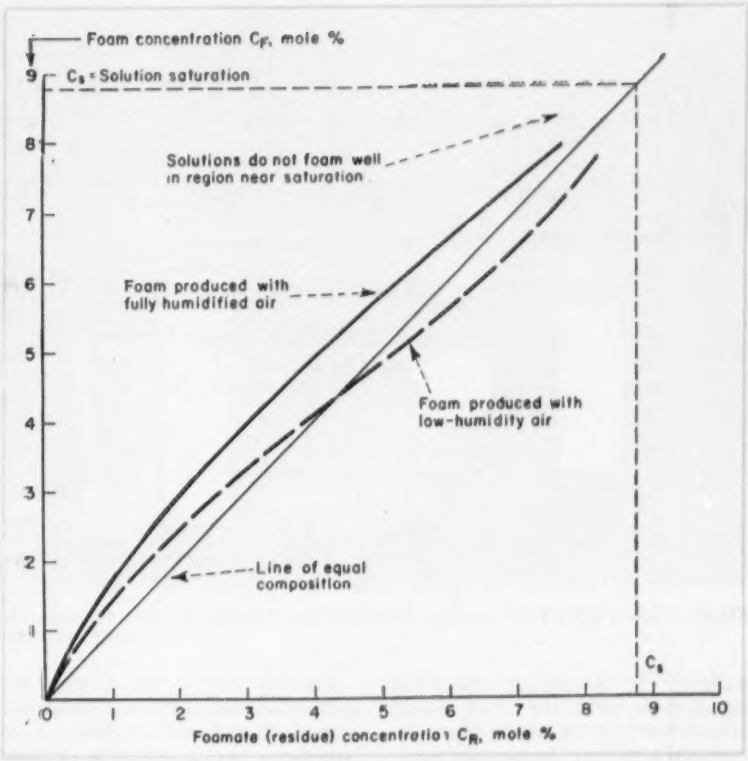
The degree of separation attained in foaming is dependent to a large extent upon mechanical variables.

Transfer of the surface-active components to the gas-liquid (bubble) interface is not instantaneous. Low rates of gas flow and slow draining foams are therefore believed to give better fractionation, on account of the longer time that foam bubbles are surrounded by solution.

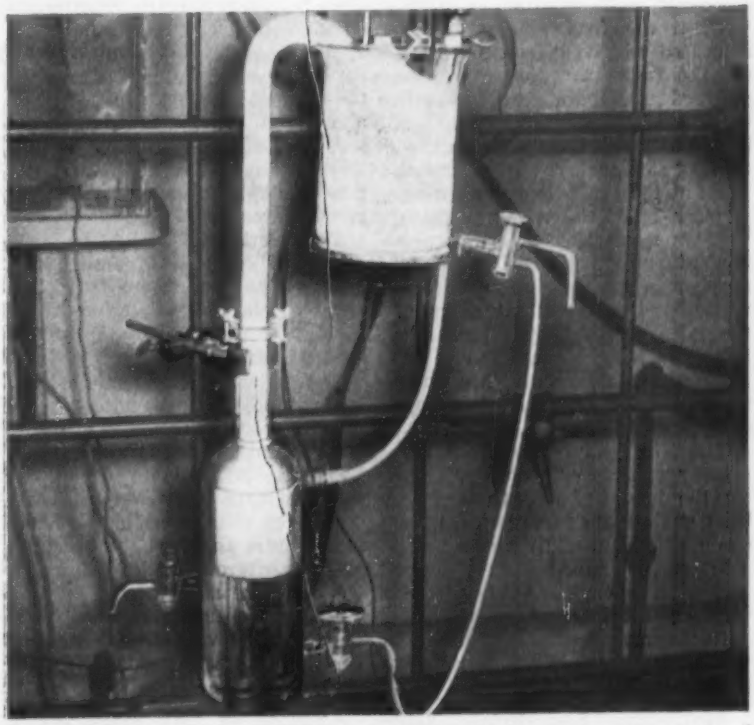
Since a bubble drains as it rises, it enriches those below it in the foam column. The mass transfer which occurs as bubbles rise in counterflow to drainage liquid is truly a differential countercurrent process like that encountered in packed and spray towers. Drainage then provides a form of internal reflux, and separation efficiency increases with an increase in the height of the foam column.

Another interesting feature of foam fractionation is also demonstrated in Fig. 7. The solid curve, previously mentioned, represents data obtained for an alcohol-water solution foamed with completely humidified air. If, on the other hand, an air stream of lower humidity is used, a curve of the type dashed in Fig. 7 is noted.

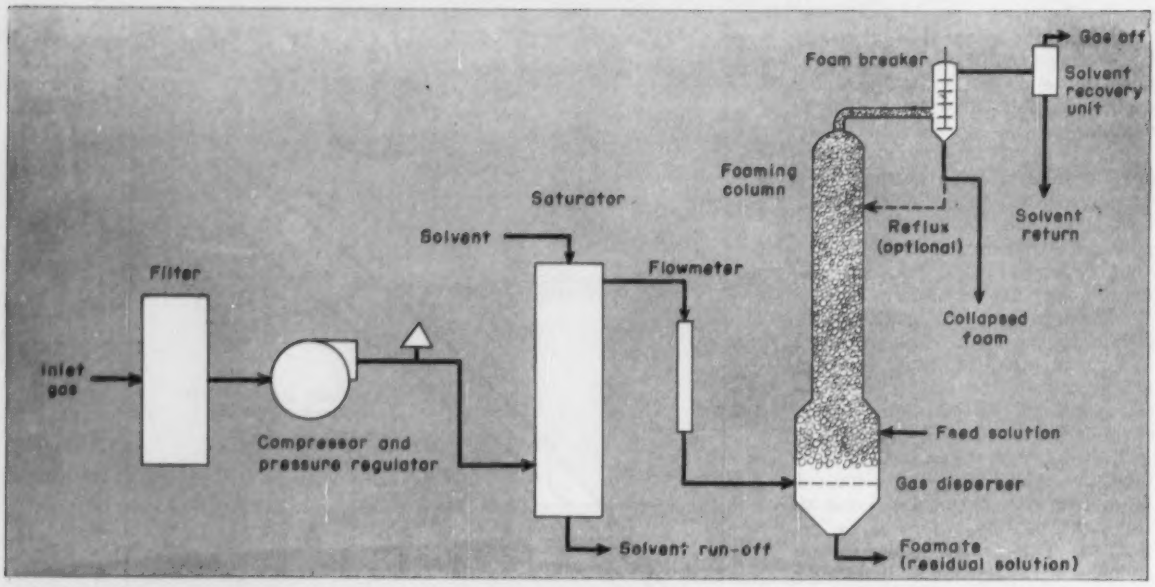
How can these differences be ex-



RELATIONS between foam and foamate concentrations. (Fig. 7)



BENCH SETUP of foam column and foam breaker separates components of solutions on basis of variations in surface activity. (Fig. 8)



FOAM FRACTIONATOR flowsheet suggests how commercial unit for separating solutions might be set up. (Fig. 9)

plained? If the Gibbs adsorption equation is valid, the foam should always be richer in alcohol than the residual solution. Apparently preferential evaporation of water into the unsaturated air stream is responsible.

When the foaming gas is not saturated with volatile components of the mixture, they will be stripped out. In this case water—the more volatile component—is being removed from the solution, tending to enrich it in alcohol, while at the same time surface adsorption tends to enrich the foam. The two competing processes proceed at rates dependent primarily on temperature, solution concentration and degree of saturation of the inlet gas. At some point the two rates become equal and no enrichment is observed. Then foam and foamate concentrations are equal.

Thus, in foaming solutions containing volatile components, varying the degree of saturation of the inlet gas stream permits a marked change in foam-solution concentration relationships. Both positive and negative enrichment can be effectively attained with a surface-active agent which should be positively adsorbed.

Another device which may be used is alteration of the temperature during foaming. Each surface-active material has a critical foaming temperature above which a liquid containing this substance alone is unable to foam. Separation of one component from a mixture of surface-active substances may be enhanced if, during foaming, the liquid temperature is kept above the critical frothing temperatures of the other components. By lowering the solution temperature in stages, all components may be recovered.

This method of course is inapplicable if the critical foaming temperatures of the components are almost equal to each other or if they are so high as to involve significant heat damage.

These points suggest that in cases where foam-foamate concentration relationships are unfavorable, alterations in operating conditions may be made to permit the mixture to be separated by foaming. Such alterations may include temperature and the nature and degree of saturation of the foaming gas with the solvent.

In batch operation the foaminess of a solution will change as fractionation takes place, since the surface-active components, which give rise to foam, are progressively removed. Again this suggests an analogy to distillation where the boiling point of a batch rises as the more volatile component is removed.

Foam stability may, in fact, be used as an indication of the progress of separation. A change in foam character, like a sudden increase or decrease in foam height at a constant inlet gas rate, is a sign that one component has been removed from the mixture by the foam.

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MONDAY, JULY 9, 195(

Fresh Water From Sea Is Envisioned by 1990

WASHINGTON, July 8 (AP) —Fred A. Seaton, Secretary of the Interior, said today that by 1990 "you are likely to see a network of pipelines criss-crossing America carrying fresh and palatable water de- from the sea."

said the Interior Office of Saline ation

1956— Small units already working

A number of plants now make fresh water from salt water using the electric membrane process. Here's how the process looks in terms of operation, maintenance and cost. Also, what the future holds.

More Fresh Water Via Membranes

T. A. KIRKHAM, Ionics, Inc., Cambridge, Mass.*

An important role in the world-wide treating of water supplies for many purposes seems in the making for ion exchange membranes.

A number of smaller plants now have been operating for more than a year. Larger plants are being designed. At least one of these should go on stream this year.

What's significant about electric-membrane demineralizers is that they convert saline water to fresh water, and do it within reason cost-wise. In the brackish range (1,000-6,000 ppm.), the membrane process is pre-eminent. It can demineralize water more cheaply than other processes can demineralize waters of any salinity.

In the face of rising demand for fresh water, conversion of saline water assumes increasing importance. Partly, this is due to the inequitable distribution of rainfall. Then, much of the rainfall evaporates before it can be utilized. A large part of the remainder passes into the ocean and underground.

It is from sources such as these that a growing stream of saline water will be tapped for conversion to fresh water. On July 9, 1956, the *New York Times* quoted Fred A. Seaton, Secretary of the Interior, as saying that the Interior Dept.'s Office of Saline Water Investigation was working on a "tremendously important program" to claim drinking water from the sea or from "sources of brackish water which are unfit for human and industrial use today." Several different methods are under investigation.

What is the Limiting Cost?

Basically, conversion of saline water to fresh water is one of the simplest chemical separation problems. Today, there are many ways to do this. But to be acceptable a process must, of course, offer low cost.

To compare favorably with present-day costs for average household water, a process must produce fresh water at a total cost of approximately 30¢. And this limit will prevail whether you are treating sea water to remove 290 lb. of salt per 1,000 gal., or brackish water to remove 29 lb. of salt per 1,000 gal. Thus, analysis of any treating process must emphasize cost.

Before we discuss the economics of the electric-membrane process let's look at how the process operates so that we may understand what the costs mean.

Separates Salt From Water

Fresh water may be produced from saline water either by separating the water from the saline solution, or by separating the salt from the water to decrease salinity.

The electric-membrane method is the second type. For news of first type, see pp. 126-134.

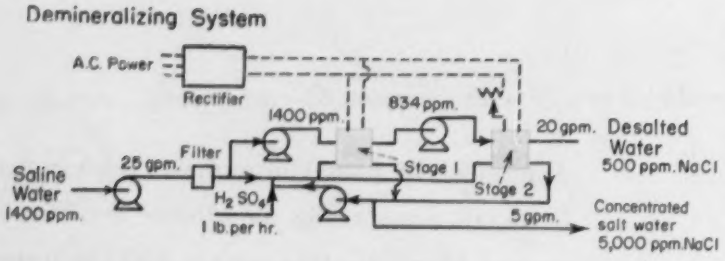
The electric-membrane process operates by use of selective cationic and anionic barrier membranes. The plastic cation membrane, operating under a d.c. potential, allows positively charged ions such as sodium to pass through. Fixed negative groups, distributed evenly within the insoluble matrix of the membrane, prevent passage of anions through the membrane.

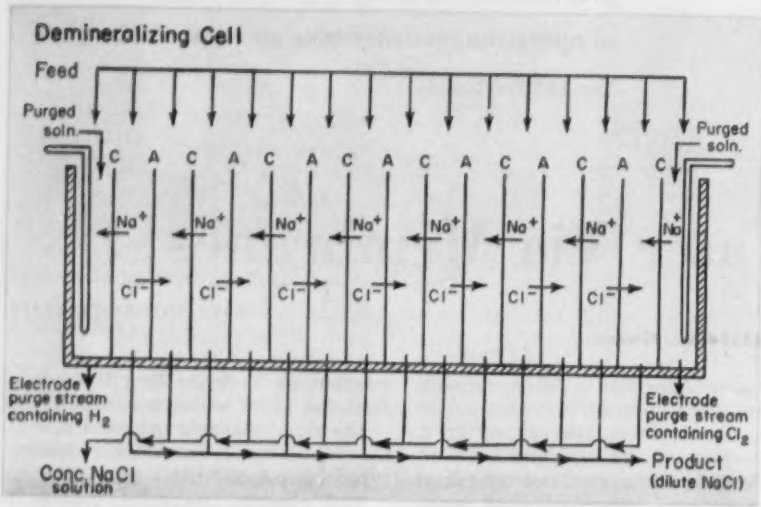
The anion membrane is constructed similarly and operates in like fashion but is selective for anions.

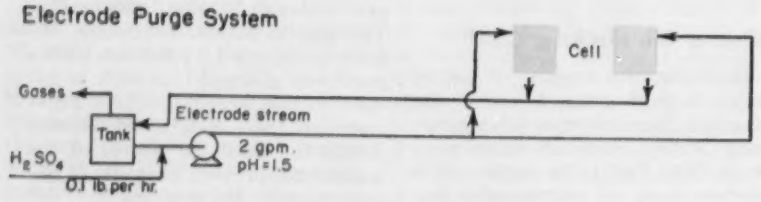
An individual cell consists of an anion membrane and a cation membrane, separated by spacers to permit flow of the saline water between them. Multi-cell systems have cation and anion membranes arranged alternately and connected in series between a single set of electrodes.

When d.c. voltage is impressed across the terminal electrodes, the ions migrate so that salt content increases in one-half the flow passages and decreases in the remainder. The basic multi-cell system can separate a multitude of highly ionized constituents from non-ionized or slightly ionized constituents.

* Meet your author on page 386. This article adapted from paper presented before American Power Conference, Chicago, March '56.







More Power, More Water

Selectivity of the membranes is high, particularly in the brackish water range. Therefore, the capacity of the system can be determined using Faraday's Law, remembering that each equivalent of current transfers an equivalent amount of ions through membrane.

Input of d.c. energy to the system is proportional to I^2R. Resistance of the system is approximately constant for a fixed decrease in salt content of the diluting stream (stream from which the salt is being transferred). Under such conditions, production rate or throughput of water is proportional to the current or d.c. voltage, while the power is proportional to the square of the current.

With this in mind, you can see that for a fixed decrease in the concentration of the diluting stream, production rate can be changed radically by varying the consumption of d.c. energy over a wide range.

Of course, there is a maximum d.c. voltage or power input for maximum production at a given set of concentrations and flow rate. Further increase of power input beyond this point decomposes the water, reduces efficiency and increases throughput only slightly.

If electrode overvoltage losses are neglected, the resistance of a series of membrane cells is the sum of the resistances of the individual membranes and flow passages. Resistance of a flow passage is approximately proportional to the average concentration of salt solution within the flow passage. Except for Donnan diffusion at the higher concentrations, resistance of a membrane is approximately constant.

These resistance characteristics mean that at lower concentrations a fixed d.c. voltage across the system tends to maintain a constant ratio of concentrations between the influent and effluent ends of the diluting stream. At high concentrations, the system tends to maintain a constant concentration difference, between the influent and effluent ends of the diluting stream.

The foregoing correlations of energy, throughput and membrane area are expressed by the mathematical relationship:

$$(N_i - N_o) \log_{10} (N_i/N_o) + (N_i - N_o)^2/(10)^4 = 6A\,U/F$$

Since certain assumptions are inherent in the derivation of this equation it is considered only an approximate relation.

Membranes Work in Stacks

Design of an electric-membrane demineralization plant is based upon a standard membrane unit known as a membrane stack. Approximately 300 membranes measuring 18 × 20 × 0.03 in. and a like number of plastic spacers the same size comprise the stack. Stack has a single set of electrodes.

Over-all height of the stack is approximately 30 in. Membrane-pair area available for salt transfer is about 185 sq. ft. per stack. Flow capacity of the stack is 20 gpm. for each of the two streams.

To maintain this rate of flow involves a pressure drop of 30 psi. which is equivalent to an average pumping power of 2 kw. per stack, or slightly less than 3 hp.

How membrane stacks are hooked

Nomenclature

- N_i Total dissolved solids in feed water, ppm.
- N_o Total dissolved solids in product water, ppm.
- A Plant membrane-pair area, sq. ft.
- U D.C. energy per unit of water produced, kwh. per 1,000 gal.
- F Production rate of demineralized water, thousands of gallons per hr.

$(U)/(N_i - N_o)_{max.} = 2.5 \times 10^{-5}$ kwh. per 1,000 gal. per ppm. $(N_i)_{max.} =$ 6,000 ppm.

up with auxiliary equipment is shown in the adjoining flow chart. This illustrates the production of 28,000 gal. per day of 500 ppm. product water from a 1,400 ppm. brackish water.

Before water enters the membrane stack it is pretreated by sand filtration or a combination of steps that may include aeration, settling, coagulation, chlorination and sand filtration, depending upon conditions.

The product or diluting stream is passed successively in series fashion through the two membrane stacks. Approximately 40% of the salt is removed in each stack. Thus, in two-stage operation 64% of the salt is removed from the water. This corresponds to the maximum safe energy input to the membrane stacks. For most applications, the maximum energy input in this range of concentrations is the optimum condition from the standpoint of cost.

Proper demineralization is controlled by adjusting stepped transformers and rheostats to regulate the d.c. voltage input to the individual membrane stacks.

The concentrating-stream sides of the membrane stacks are connected in parallel from a closed recirculating loop. That way, a single concentrate pump suffices and waste water is conserved.

The concentrate loop is blown down and continuously diluted by raw feed water. In most cases a blowdown rate of 25% or less is satisfactory. On the flow chart, you will note that concentration of the waste stream is 5,000 ppm.

A separate stream serves the electrode compartments at the ends of the stacks. All these compartments are connected in parallel and recirculation is employed.

The electrode stream removes dissolved and gaseous products produced by chemical reactions at the electrodes and it prevents formation of basic precipitates in the cathode compartment and adjacent flow cells. In the second instance, a small amount of acid is introduced to prevent deposition of scale.

A Look at the Costs

Due to the relationship between plant size, power consumption and throughput (Eq. 1) the investment can always be optimized for any particular application.

Estimated costs of water, ¢/1,000 gal.

	50,000 gal. per day	500,000 gal. per day	5,000,000 gal per day
Agricultural	10	3	0.5–3
Industrial	10–500	2–100	2–8
Household	30–500	30–100	20–60

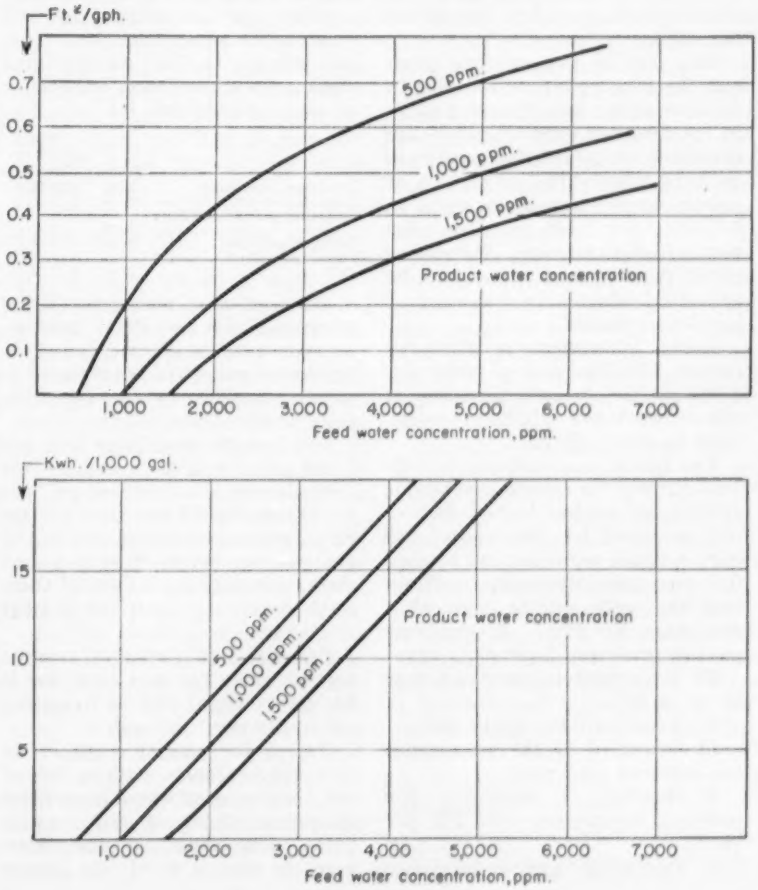
Major costs can be classified as 1) charges that decrease as plant size is decreased for a fixed throughput rate, and 2) charges that increase as plant size is decreased for a fixed throughput rate. In the first group will be found fixed charges on investment (except rectification equipment), cost of replacement parts and power for pumping. In group two are fixed charges for rectification equipment and charges for d.c. power.

For brackish waters, the minimum total cost per thousand gallons occurs where the cost of d.c. power is approximately equal to the summation of charges under classification (1). However, it is not possible to balance these factors under present conditions.

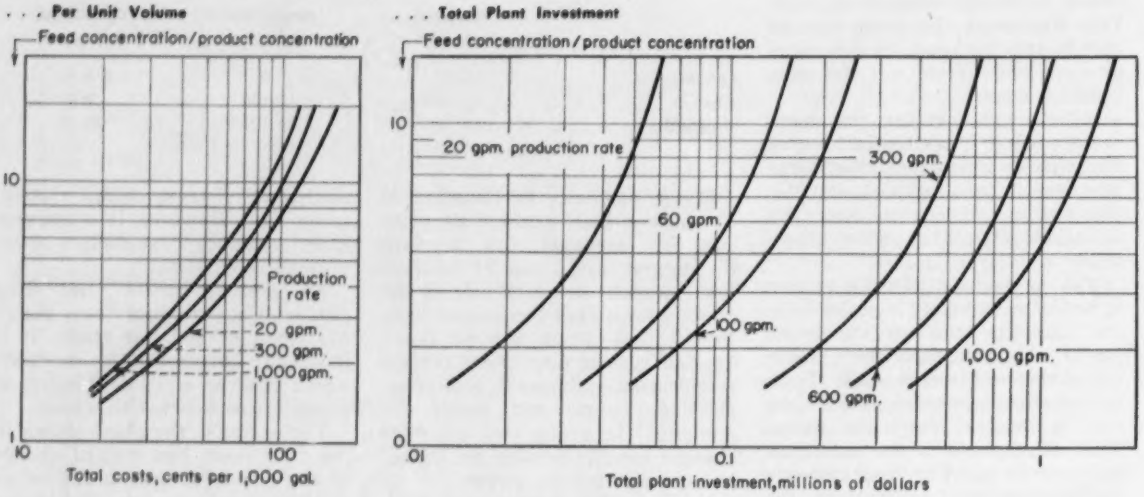
At present prices, the fixed charges for (1) range from 15¢ to 25¢ per 1,000 gal. per stack. It is physically impossible to use anywhere near an equivalent value of power for most brackish waters.

For example, the plant shown in the flow chart has a fixed charge of 43¢ per 1,000 gal. in the range of 100,000 gal. per day. The stacks consume approximately 3 kwh. per 1,000 gal. At 1¢ per kwh., the plant is far from the optimum power in-

How Feed Water Affects Unit Area and Power



Costs to Demineralize Saline Water



put where the cost of power would balance the fixed charges.

If it were possible, the optimum would dictate a plant approximately ¼ the indicated size. Then total cost per 1,000 gal. would be 25¢ rather than 46¢.

The size of a membrane plant and the total power consumed as a function of the total dissolved solids in the feed and product waters are presented on p. 187 for maximum input of power. The correlation of power consumption corresponds to 5-7 kwh. per 1,000 gal. per 1,000 ppm. of solids removed. The size of plant, given by the curves, can be converted directly into number of membrane stacks.

Dollar investment is given by curves. The total cost of water per 1,000 gal. for the case of maximum power input and minimum investment is shown above.

The investment plot can be utilized directly for any concentrations of feed and product waters. Figure was prepared for the case of 500 ppm. product water but can be used for any concentrations, realizing that the costs will be high by a maximum of 20%. Assumptions used in preparing these plots were:

1) Investment is amortized over 25 yr. at 3%.

2) Anodes are replaced yearly.

3) One-third of the membranes are replaced each year.

4) Maintenance materials for nonstack components cost 2% per year.

5) Operating and maintenance labor is 100 man-hr. per stack per yr.

6) Energy costs 1¢ per kwh.

The investment figures include materials, direct labor, building, auxiliary services, engineering and construction supervision. Excluding the energy to the rectifier and stacks, the approximate breakdown of cost per 1,000 gal. is:

	Percent	Cost ¢/1,000 gal. per stack
Membrane replacement	42–46	6.5–10.0
Investment amortisation	23–28	3.6– 6.1
Operating and maintenance labor	9–13	2.0
Replacement parts	9–10	1.5– 1.9
Pumping power	8–11	1.7
Acid	1– 4	0.2– 0.4

Replacement of membranes is the greatest single cost item. Less expensive membranes and lower replacement rates can be expected to reduce significantly the operating costs of membrane plants.

Total costs vary from 20¢ per 1,000 gal. for a 40% single-stage operation in a 1.4 million gal. per day plant to $1.33 per 1,000 gal. for 92% 5-stage conversion in a 28,000 gal. per day plant. Energy to the stacks accounts for 3-25% of these costs, depending upon the number of stages.

Based on a 1954 study, maximum cost of water for municipal use is 38¢ per 1,000 gal. and for irrigation water 12¢ per 1,000 gal.

Except for special crops of an extremely valuable nature, use of the electric membrane to produce irrigation water is not feasible today. For household uses, however, the electric membrane process can demineralize saline waters at total costs approximately equal to or less than costs for producing water in many parts of the United States and the world today.

Present and Future Plants

By early 1956, eight electric membrane plants had been constructed and operated. A considerable number of new plants will start operating during 1956.

Some comments on the plants listed in Table II will explain some of the special features and conditions prevailing at each installation.

Plant 1 was the first successful installation. It operated essentially unattended and was instrumented to shut down and sound a warning if an abnormal condition developed. Located on the shore of Cape Cod, this plant required a startup and servicing call every 2-3 weeks. Because the plant was experimental, operation was discontinued in the spring of 1955.

Plant 2 produces drinking water for a mining camp of 150-200 men. Operation of the unit has been largely unattended.

Plant 3 is a mobile unit supplying fresh water for an exploration crew of 30 men.

Plant 4 is the first so-called continuous plant. Due to fine cooperation rendered by the Texas Electric Service Co., this plant has supplied basic design information.

Plant 5 is a mobile unit operated

Roster of Installed Electric Membrane Units—Table II

Plant #	Operator and Location	Date of Start	Type of Plant [2]	Purpose of Plant [2]	Source of Water	Total Hours Operation	Feed ppm. TDS [5]	Product ppm. TDS	Production Rate, Gph.	DC Power Demand, Kwh.	Plant Membrane—Pair Area, Sq. Ft.	Total Energy Consumption Kwh./1000 Gal.
1	Ionics, Inc.— Eastern Seaboard	2/54	B	X	Ocean	5,300	32,000	300	17	0.9	100	100
2	Plant A[4]	6/54	B	P	Well	6,900	2,400	1,000	100	0.4	75	20
3	Plant B[4]	10/54	B	P	Well	3,000	2,000	500	200	0.4	125	15
4	Texas Elect. Service Co. Wichita Falls, Tex.	10/54	C	X		4,500	1,700	400	1,200	4.5	500	12
5	Department of Interior Buckeye, Ariz.	1/55	C	X	Well	740	4,000	400	1,000	9.2	750	20
	Miller, S. D.	8/55			Well	540	2,000	700	1,700	5.7		10
6	Bahrain Petroleum Co Bahrain	6/55	C	P	Well	5,000	3,150	400	1,260	8.4	937	16
7	Bureau of Yards & Docks Calif.	9/55	B	X		1,500	3,500	175	75	0.8	106	15
8	U. S. Air Force Texas Tower #2	11/55	B	P	Ocean	1,000	32,000	500	60	6.4	375	130

[1] All figures are averages. [2] B—Batch. C—Continuous. [3] X—Experimental. P—Commercial Production. [4] Customers prefer nondisclosure. [5] TDS—Total dissolved solids.

for about 10 months under the joint direction of Ionics, Inc., and the Dept. of Interior. Some of the major contributions to improvement of the electric membrane process came from the Dept. of Interior tests. Direct labor requirements used in the cost evaluation were obtained from these tests.

Plant 6 is the most modern of the plants now operating. It is the first continuous commercial plant and has been on stream more than 90% of the time during the first seven months. The 30,000 gal. per day output supplies several thousand people in a hot arid Middle Eastern town with 60% of their fresh water. Operation has been so satisfactory that a three-fold expansion is now underway.

Plant 7 is the first of two pilot plants now under evaluation by the laboratories of the Bureau of Yards and Docks.

Plant 8 is on the first of the Texas Towers located off the New England coast as an off-shore radar station. As the first commerical sea water unit, it is supplying part of the fresh water needed by the 60-man crew.

Factors That Affect Operation

During operation of the foregoing plants over the past two years, many important facts and solutions to problems were uncovered. A few are worth mentioning in detail.

Solids Removal—Because the flow passages within the membrane stack are narrow, any significant amount of suspended solids must be removed from the feed water. Organic solids form a slimy coating on the membrane surfaces.

Suspended silt or sand in deep-well water should be removed by settling or filtration. Colloidal material suspended in surface water requires coagulation and sand filtration. For less than 20 ppm., diatomite earth filtration is satisfactory.

Bacterial Growth—Membrane stacks serve as breeding grounds for many types of bacteria found in non-sterile water. Pre-chlorination to maintain residual chlorine content in the product water has solved the problem.

Iron Fouling—Waters containing 0.3 ppm. or less of iron have been demineralized over operating periods of thousands of hours without pretreatment. Where iron content is 1.0 ppm. or more a brown slime deposits on the membranes. Eventually, it may affect performance of the system. Therefore, it should be removed by oxidation and filtration.

Sulfide Fouling—In the Middle East, waters were encountered that contained large amounts of iron (5 ppm.) and hydrogen sulfide (60 ppm.). Untreated water deposited an adherent, black, glossy film which could be removed from the membranes only by chemical treatment. Under these conditions, many membranes became brittle and ruptured.

Feed water of this type was pretreated by direct chlorination and filtration. A large installation would rely on aeration-settling to reduce the chlorination-filtration load.

Scaling—Most brackish waters are supersaturated in calcium carbonate and many are close to being saturated in calcium sulfate. Normally, there is no scaling on the membrane surfaces that bound the diluting stream. However, calcium carbonate scale does form on the membrane surface facing the concentrating stream.

Sulfuric acid fed continuously to the blowdown stream reduces the concentration of bicarbonate ions and prevents formation of scale. The pH of the diluting stream is not affected; that of the concentrating stream is changed about 0.5 pH units.

Consumption of acid runs about 1 lb. per 1,000 gal at a cost of 1 or 2¢ per 1,000 gal.

Scaling by calcium sulfate has been less serious and can be controlled completely by adequate blowdown. Continuous operation is possible when the blowdown stream is approximately 20% supersaturated with calcium sulfate. When the sulfate does precipitate, it forms a non-adherent solid which is removed easily by flushing out the unit.

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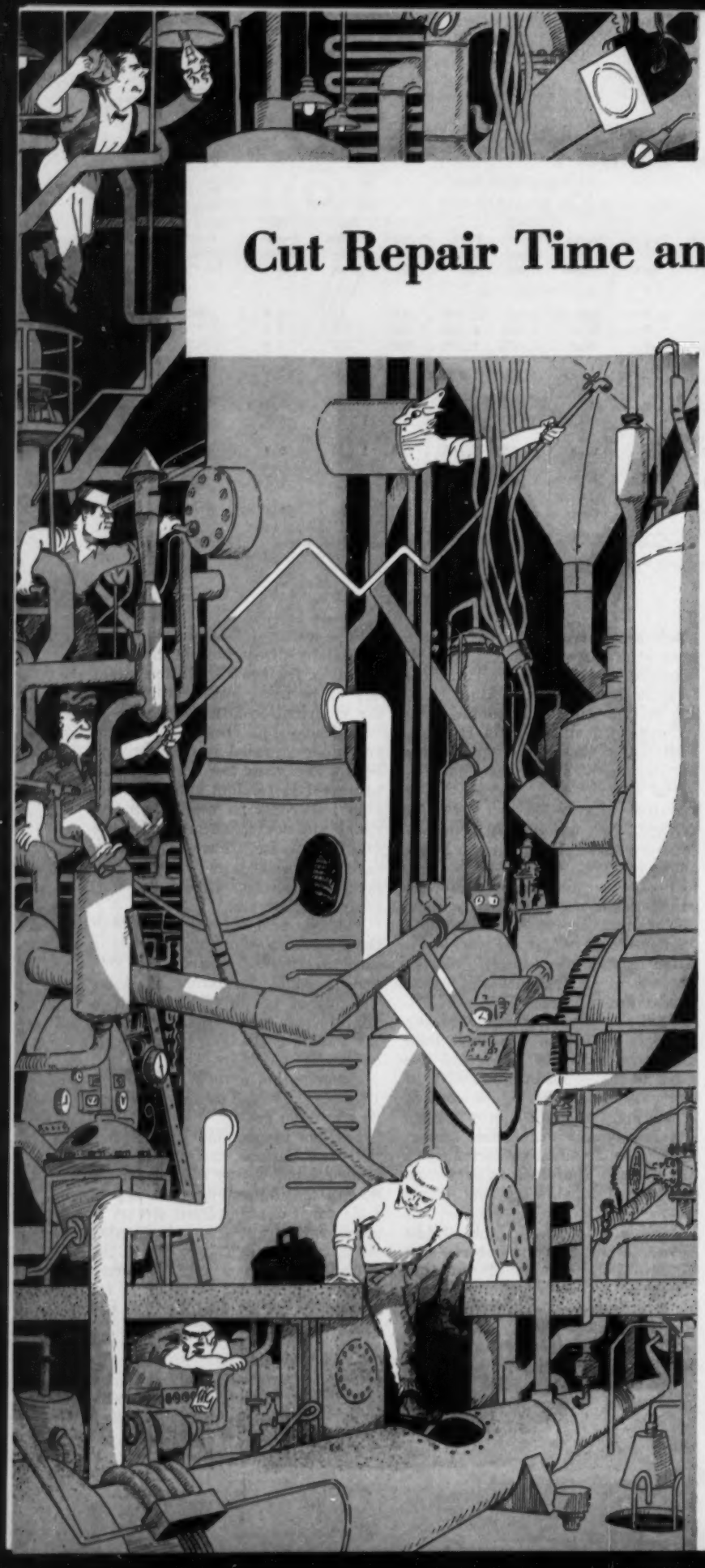


Cut Repair Time and Costs With

Here are some ways to turn hindsight into foresight and avoid maintenance headaches imposed by improper design.

WHEN you produce a marginal product under competitive sales pressure, you must keep all costs at a minimum per unit of product.

In many cases, the manufacturing cost, excluding maintenance, is fixed for any given product output.

That's where maintenance cost becomes a mighty important factor. For in most cases, it varies with design, type of equipment and process. And how it varies can determine whether those dollars trickling into maintenance expense grow sufficiently large to drop you into the red.

If you design with an eye to maintenance, you actually do an economic analysis. Even so, there are instances where no additional expense is entailed. Such is true where lower maintenance is achieved through careful selection of equipment and materials, better layout of equipment and plant and adherence to good construction standards.

Should design for lower maintenance-cost result in greater expenditure of capital, it must be well qualified and justified on the basis of lower unit-cost for product manufactured. Decreased cost of maintenance must be weighed against increased cost of installation. And you should keep in mind that good design and sound practices can shrink maintenance costs without boosting new project and installation costs.

Consideration of maintenance should be one of the prime design factors along with capacity, cost, etc. Yet, too many jobs are turned

* Meet your authors on page 388

Alert Design . . . Check Your Trouble Spots Here

LEONARD SCHWAB and B. G. EARNHEART,
Monsanto Chemical Co., Texas City, Tex.*

out with little consideration given to maintaining the item, unit or equipment economically over the many years of estimated life.

Designing for maintenance is not difficult. Most engineers know the basic principles. And the search for sounder principles has brought closer coordination between design and maintenance groups to effect better operating flexibility, better interchangeability and more "on-stream" hours with less maintenance.

When you are designing a unit and are trying to consider the maintenance factor, place yourself in the position of the maintenance department. Ask a few questions (see adjoining list) about what will have to be done when maintenance work is required on that particular part of the unit. Many of these questions will ring a familiar bell for a number of operating and maintenance men.

Start With Underground

First, consider underground work —foundation, sewers, piping. It may cost a little more to install your underground so that it can be maintained. But, if you recall past jobs you'll probably agree almost every one has cost well over what you thought it should.

Next, take a look at your structures and buildings. Have you ever heard of a structure or building collapsing because it was underdesigned? But, you have seen them so jammed with equipment and piping that you couldn't walk through them, much less have room to work in the space. (*Continued next page*)

Underground

- Do all the underground piping and sewers avoid passing under slabs and foundations?
- Are there enough cleanout points?
- Are floor drains trapped in case someone ties into a sanitary sewer on down the line?
- Can line be excavated for repair or replacement without losing part of the foundation around it?
- Can the sewer or line be blocked off and purged of explosive or dangerous gases so that maintenance work can be done?

Structures and Buildings

- Is there enough room to permit work around the equipment?
- Have structural members been located over equipment for hoists?
- Is there enough aisle space for moving equipment?
- Has sufficient work room been provided around exchangers to permit rodding, drilling and retubing in place?

Piping

- Is arrangement so complex and compact that you can't install blinds, operate valves, or make repairs and welds?
- Does the piping block the aisle and work area needed for removing and repairing equipment?
- Do you have head knockers?
- Can you get to valves to operate, replace or repack them?
- Do pipelines have flanges for installing blinds to isolate sections of the pipe?
- Are there connections for depressuring, flushing, venting or steaming out?
- On insulated lines, is there sufficient space for working on these or adjacent lines after the insulation is installed?
- When or where should block valves be installed on lines that branch off service and utility headers?
- Do valves and fittings meet your standards for face-to-face dimensions?
- Where have you located your control valves?
- Is a scaffold needed to reach them?
- Is there a bypass around them?
- While on bypass, is there a bleeder to depressure the valve for maintenance?
- Is the bypass above the valve, so that the mechanic can use it to lower the valve to the ground?

Equipment

- When purchasing equipment, how much consideration is given to its maintenance?
- How easy is the unit to disassemble?
- How critical are dimensions and clearances on reassembly?
- On mechanical seals for pumps, can seal be adjusted properly or replaced easily? What piping is needed for good seal operation?
- What type of exchangers should be used?
- When should exchangers be operated in parallel?
- Have provisions been made for removing and reinstalling overhead condensers in the top of towers? Also, for testing efficiently; retubing in place?

Lighting

- Is lighting adequate for night maintenance?

Insulation

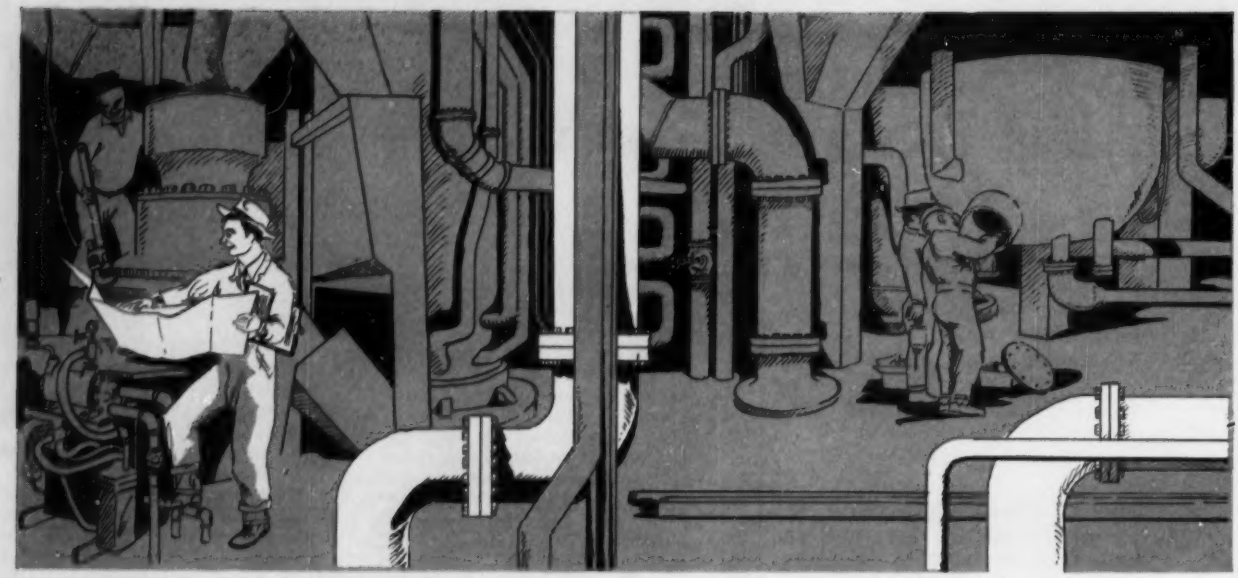
- Do you paint under insulation, temperature permitting, to prevent corrosion?
- Does the flashing used on tanks, towers, etc., protect well?
- What type of insulating materials have been specified?
- Do the maintenance men object to working with it?
- Will it stand the abuse from men walking on it?

Painting

- How much money is spent in your plant for maintenance painting?
- Do you consider it excessive?
- How much of the cost could have been cut if galvanizing had been used on the original installation?

Flexibility

- Is flexibility required in new unit?
- How much flexibility justified?
- How many heat exchangers within plant or unit can be identical?
- Does the equipment on a high bid interchange with that already in service? if so, does the price difference justify its selection?
- If equipment offered does not match installed equipment in size and design, can specification be changed so that it does? How much will price change?



Many maintenance men have had to clean or retube an exchanger where there is no access to the end, or where there is no room to use a rod long enough to reach through the bundle. When equipment is being located, the possibility of the exchanger fouling or corroding must be considered. Necessary work room must be provided for removing the exchanger for repairs or replacement.

These considerations apply to any piece of equipment, for most units will require maintenance work at one time or another.

There are occasions when considerations of this type lead to expensive installations. In such cases, the economics must be weighed.

However, remember that numerous details considered during original design can prevent maintenance nightmares, at little or no more cost than a less desirable, alternate method of installation.

Piping a Major Factor

In the modern chemical plant, piping plays a major role. It has been said that it takes 10 to 20 years to develop a top-notch piping layout man.

This is understandable considering the complexity of piping arrangements. No effort will be made to detail this part of the subject, since it is a field by itself.

There a few items, however, which would make the life of a maintenance engineer much easier. We feel that the dollar sign on original construction plays too large a part in the decisions on piping design. In most cases after a year or two of operation, and at extremely high maintenance cost, this policy leads to rearrangement of the piping and installation of extra valves, flanges and drains needed for maintenance.

A question which probably never will be settled is the location of block valves on lines branching off service or utility headers. For economic reasons, the design people want very few. On the other hand, for convenience and to prevent downtime operations and maintenance want one at each take-off.

Each case must stand on its own merit and be justified. The design engineer should consider the number and magnitude of shutdowns which will be required during the life of the system for repairing leaks or tieing-in other lines. Then, he may be more inclined to install a few more block valves.

Sometimes, in the use of alloy pipe an item is specified which does not conform to standards. Just remember when you do it, that you may be stuck with it. At some future date, additional downtime may be necessary to change and rework the piping.

Eye Equipment for Maintenance

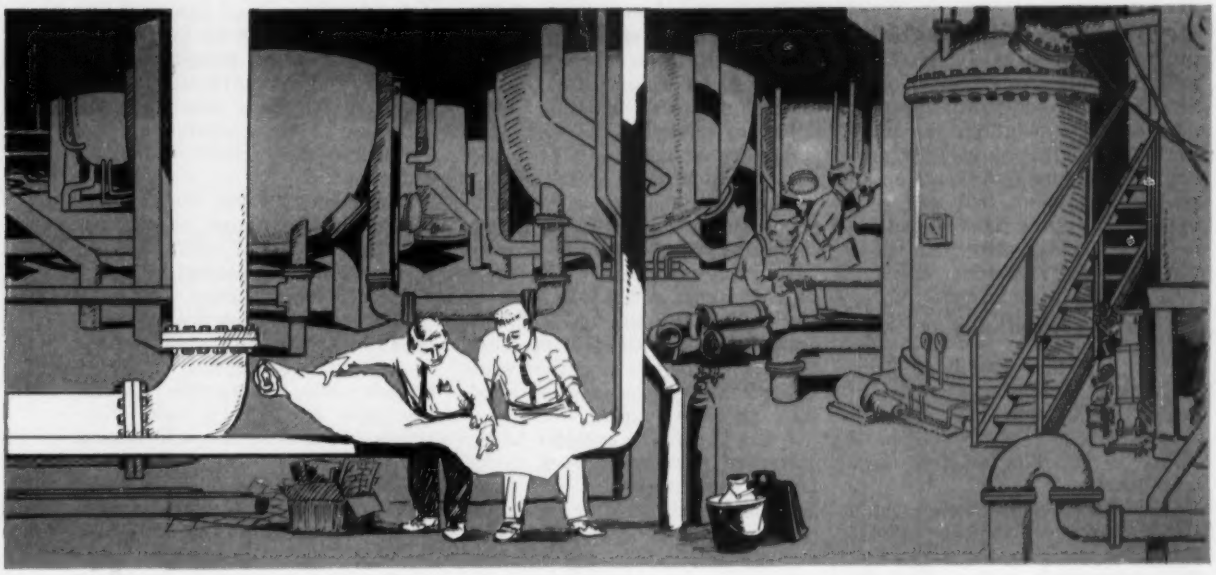
When a new piece of equipment is purchased, how much attention is given to its maintenance? How much time and money will be spent training mechanics to make repairs?

Some pieces of equipment were not designed to be taken apart and repaired. When maintenance is required, the cost and downtime are excessive.

Sales engineers have been heard to state that so-and-so has the same equipment in his plant and it has been maintenance-free since installation one or two years ago.

With all due respect to the sales engineers, they are trying to sell their equipment and are telling the truth, as far as they know. However, how many times have security restrictions prevented you from giving the vendor anything but a favorable report on his equipment? Surely, there are numerous cases when very few of the operating and maintenance problems get back to the vendor, unless the company is unable to solve them within its own organization. Once a piece of equipment starts operating, the sales engineer knows nothing about it except what you want to tell him.

On equipment, one item to consider is the replacement of units where maintenance is expected to be heavy. Buying a spare cylinder



for a compressor or a rotating element for a pump may be expensive. But downtime often can be cut to a minimum by exchanging a complete unit on a piece of equipment. Then the unit can be repaired and made ready for the next repair job while the plant is operating.

Mechanical seals are used widely today. More and more, pump and compressor manufacturers are designing their equipment for adaptation to this type seal.

All too often the only thought in the purchaser's mind is: Can a mechanical seal be installed? One look at the adjoining equipment checklist will show you some other considerations.

Exchangers are another controversial item. In a chemical plant it is extremely difficult, if not impossible, to know the exact service conditions for the exchanger. It seems as though the impossible always happens. Polymer or sediment gets to the shell side of a fixed tube bundle or reboiler, or forms on it, or the tubes foul when they shouldn't.

There is no crystal ball capable of predicting the service required. Our only suggestion is to make a more thorough check of anticipated operating conditions.

A few things that can be checked are tube arrangement and spacing on a removable bundle so that it can be cleaned if outside of tubes become fouled; connections for acid cleaning or testing in place; design for retubing with minimum expense.

Overhead condensers quite frequently are located in the top of towers. Again, see the checklist for points to remember.

Some heat exchanger units have been built into towers so that they cannot be retubed without cutting the tower into three pieces to remove the reboiler section.

Are your installations well lit for night maintenance work? In the modern chemical or petrochemical plant, maintenance crews work around the clock along with operations. At best, lighting for night work is poor and could stand considerable improvement.

While you are at it, add enough 110- and 440-v. outlets for extension lights, power tools and welding machines. The cost of a few temporary installations will exceed original installation cost by far and be more dangerous.

Take a look at specifications for insulation and ask a few questions about your insulation work. Most of the questions raised in the checklist cost additional money. Each insulation job must be considered separately and its cost justified.

How about painting costs? In some cases, you may find galvanizing will help cut costs. But galvanize only those items where painting will make costs soar.

Some painting costs will be excessive because of the nature of the items; others because of "accessibility." Some items to consider are metal window frames; floor plates and gratings; handrails; stairways and platforms on self-supporting towers; and miscellaneous structural steel in out-of-the-way places.

Design Must Consider Safety

So far, all our remarks have been aimed at maintenance costs. One thing you must be sure to consider is safety of personnel and equipment.

Numerous small items which pertain to safety are left for maintenance men to detect after startup. Many of these can be corrected at the design stage by remembering that anything concerned with safety for personnel or equipment will be sure to benefit maintenance as well as other associated groups.

Here are some of the small items we have in mind: Install relief valves on the discharge of all compressors and positive displacement pumps; use critical orifices rather than valves on equipment oil lines; have low-oil-pressure cutoffs on large equipment; include safety switches to prevent startup of equipment until conditions have been met for cooling water, air

purges or lube oil; be certain there are sight glasses in cooling water and lube-oil lines; have a small rotameter on air purge lines to non-explosion-proof equipment; provide a temperature point on the main bearings of large equipment; protect the workmen by lockouts on all moving equipment, belt and coupling guards, gage glass protectors, access platforms, valve chain-wheel operators, and numerous others.

Provide for Flexibility

Your first thoughts about flexibility may visualize attaining it through small, duplicate units. It is management's job to decide if that type flexibility requires large investments.

Within the over-all design, think about things which can provide flexibility, and how they may affect the maintenance and cost of the units. Duplication of small parts of an operating unit may mean less unit downtime as a whole, but may require more operating personnel and more equipment to maintain.

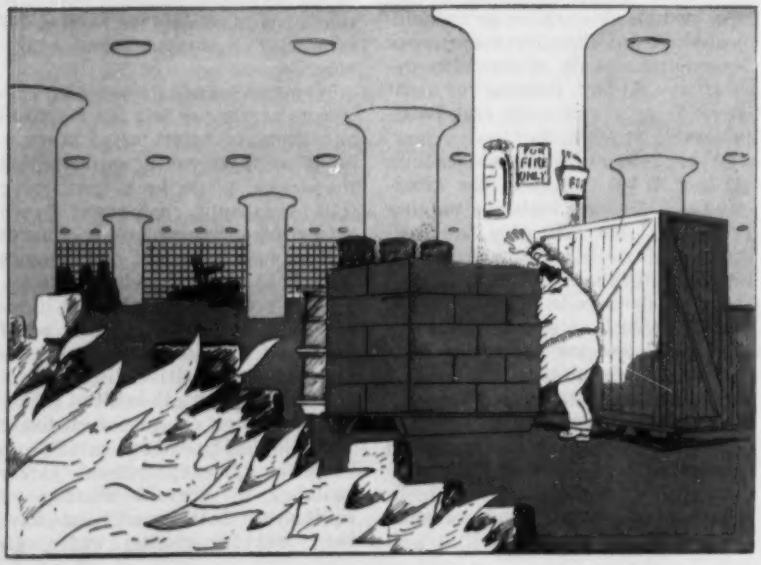
Therefore, first you should evaluate items from the standpoint of investment, operating cost and maintenance cost as opposed to the insurance for continuity of operations. Then you are better able to justify standby units and spare critical items.

Now look at design considerations that may require a different approach. For example, say that a unit will require a large quantity of heat exchangers. These exchangers should be designed for possible interchange with existing units either to minimize the cost of a permanent standby unit or to reduce the number of spare units.

How many places within the plant can you use duplicate exchangers? Would there be any objection to two smaller but more popular exchangers rather than one big "one-of-its-kind" unit? If such design were practiced more often, there would be less downtime when an exchanger fouled and less capital invested in spares.

Another point to consider in the design of heat exchangers, tanks, towers, separators, etc., is to favor interchangeability rather than the pleasing look of symmetry. How many examples can you think of where two items are similar but designed "opposite hand?" In most cases, this can be avoided with little or no additional installation cost.

Often small parts of the parent unit are sufficiently different to make troublesome their adaptability to similar units. An outstanding example is slight difference in nozzle length and location on the shells of two similar heat exchangers. This can be remedied easily by revising connecting piping to make all units identical and obtain flexibility through interchangeability.



A large degree of flexibility in chemical plants can be derived by properly selecting pumps, motors, turbines and similar rotating equipment. In too many cases, a plant will seem to be a proving ground for new and different brands of equipment.

Remember, though, that experimentation is the root of success. Firsthand results of trial and error assure equipment quality, efficiency and trouble-free service.

Many times during design, price advantage is the only measure used in selecting equipment. Take a process pump, for example. Assuming that all bidders base their prices on purchaser's specifications, the purchaser normally will choose the lowest bid. But in doing so he should review interchangeability with existing equipment. If it isn't possible perhaps equipment on one of the higher bids can be interchanged. Or the specification on a low bid may be capable of revision without too much cost penalty.

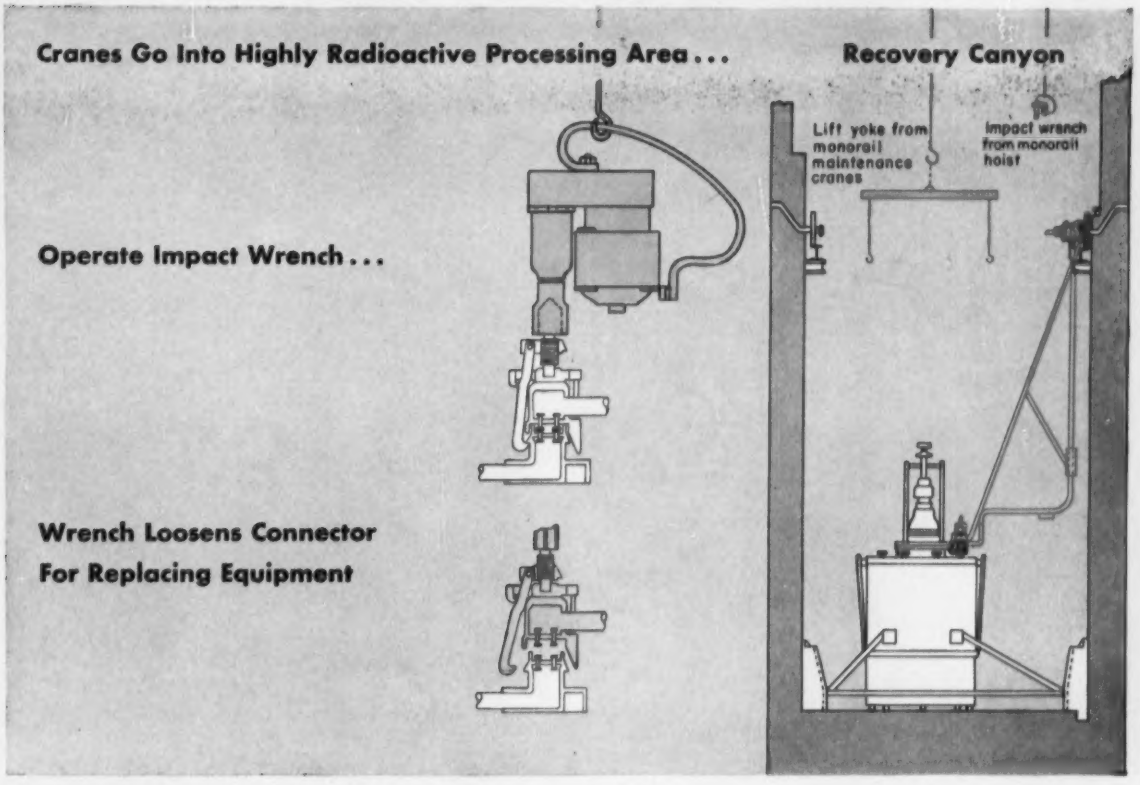
In so many cases, minimum class or size of equipment is chosen because the smaller sizes usually cost less than larger sizes. This can lead to a great variety of sizes of like equipment, made by the same manufacturer.

The problem might be compared to that confronting a storekeeper who stocked a variety of shirts by "number sizes" when his competitor stocked "small", "medium," and "large." In the case of chemical plant equipment, this would mean that some items should be over designed purposely in order to fall within "fewer size" categories.

The advantages in this method of design would again be greater flexibility through greater interchangeability. Cost for spare parts inventory would be reduced also. Justification of spare units would be simpler and even certain permanently installed, spare, standby units might be eliminated.

A final word about price. Bid price alone is not the cost of new equipment. Cost is also a function of the product manufactured, cost of maintenance, installation cost and spare parts inventory cost.

And a final word about designing for maintenance. To show the greatest benefit, it calls for close cooperation and exchange of ideas and problems between men from operations, maintenance and design.


Cranes Go Into Highly Radioactive Processing Area...
Recovery Canyon
Operate Impact Wrench...
Lift yoke from monorail maintenance cranes
Impact wrench from monorail hoist
Wrench Loosens Connector For Replacing Equipment

Remote Operations in U-235 Processing

CHARLES A. ROHRMANN, G. E. Hanford Atomic Products Operation, Richland, Wash.*

Many and complex are the problems encountered in large scale chemical processing for uranium and plutonium recovery from atomic reactors.

With the promise of widespread development and application of nuclear power, an increasing number of chemical engineers will come into contact with these problems.

The General Electric Co. operates, through its Atomic Projects Division, the Hanford facilities near Richland, Wash. Included here are chemical process plants where uranium and plutonium are separated and purified from spent reactor fuel.

A number of novel chemical equipment designs are incorporated in these plants of particular interest to chemical engineers.

* Meet your author on page 390.

But before we describe this equipment, you should have a clear understanding of why these plants are required, and what they do.

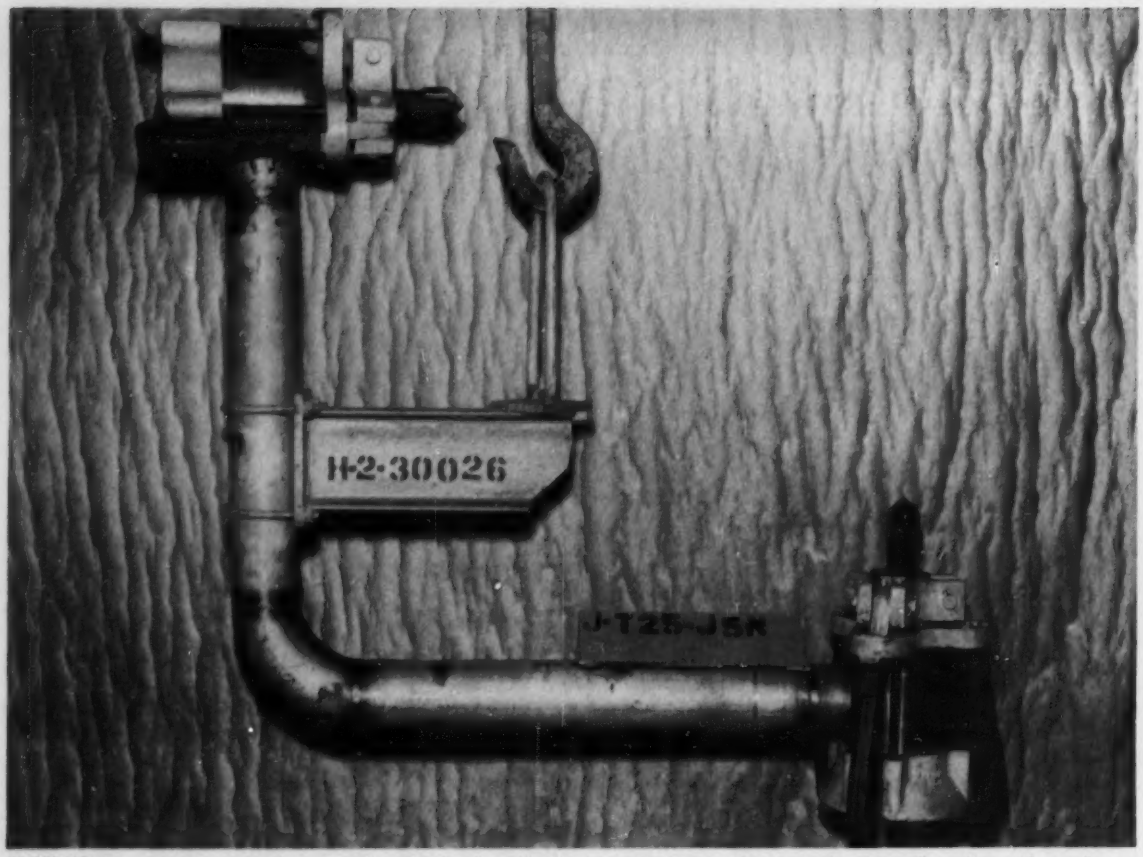
Uranium Irridiation

Uranium for use in plutonium manufacture is a highly purified material containing the two isotopes as found in nature: about one part U-235 to one hundred and forty parts of U-238.

In a reactor U-235 fissions, giving rise to fission products, and at the same time creating neutrons which maintain a chain reaction and convert U-238 to plutonium.

The reactor operation, to be self-sustaining and to produce plutonium, must produce enough neutrons from the fission of the U-235 isotope to provide for: (1) absorption in the U-238 isotope producing plutonium; (2) absorption in more U-235 isotope to cause fission for the production of additional neutrons and (3) also sufficient extra neutrons to allow for losses in the reactor structure and contents and in neutron absorbing impurities which exist in the metal, in the reactor matrix and in elements which are themselves produced from the fission of U-235. The U-235 which enters into the fission process is converted to essentially an equivalent weight of fragments, the fission products. Eventually these fission products build up to a point where the reaction is no longer self-sustaining. They then have to be removed.

The products are isotopes of about forty elements distributed about the central portion of the



JUMPER has remote connector at each end of a length of pipe. Connector heads fasten to wall and vessel nozzles.

periodic table. Fortunately, however, the largest fraction is either stable (non-radioactive) or has a half life so short that in the time between irradiation and further processing it decays to stable isotopes.

Thus after an aging period just a relatively small portion of these fission products remain radioactive. This small portion then presents essentially all of the problems of radioactivity encountered in the separation processes. The radioactive products include isotopes of the chemically unreactive noble gases such as xenon, the isotopes of biologically important elements such as iodine and other elements which are of concern because of their chemical properties, concentration, half-lives or their substantial contribution to the total activity spectrum.

After irradiation of the uranium in the reactor—to build up the plutonium content—the metal is discharged and stored for a period to minimize concentration of isotopes of shortest half-lives and to let substantially all of the residual neptunium decay to plutonium.*

Separations of Products

After the aging period, the irradiated uranium is ready for treatment by the separation processes.

The recovered uranium, which still contains appreciable U-235 isotope, must be subsequently processed by normal industrial techniques, including manual handling. Therefore, the purification requirements are extremely rigid; in fact, are probably not approached by any existing industrial process.

The radioactive fission products which exist in irradiated metal in amounts of the order of parts per million and less are reduced to levels of about one part in ten million parts originally present. Because of its extreme biological toxicity, the plutonium in the uranium must also be similarly reduced.

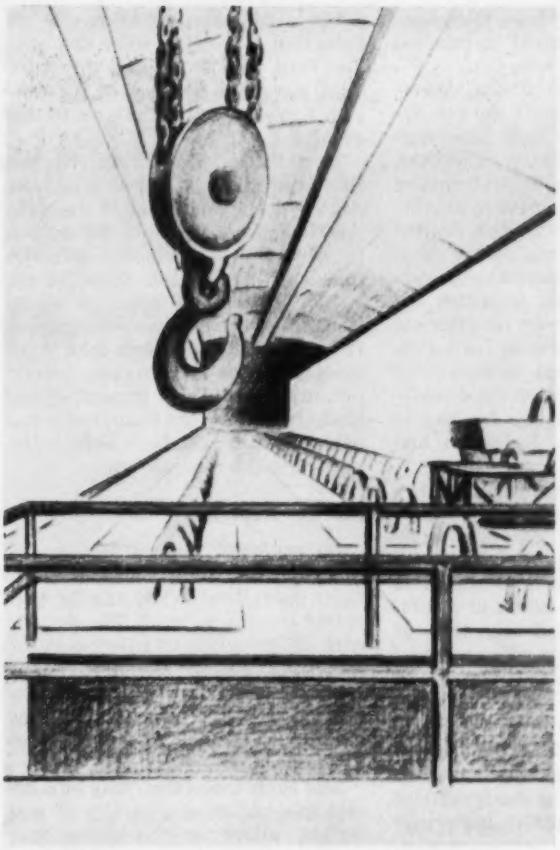
Design of Buildings

The process buildings contain equipment separated from the operators and environs by several feet of reinforced concrete for protection from hazardous radiation.

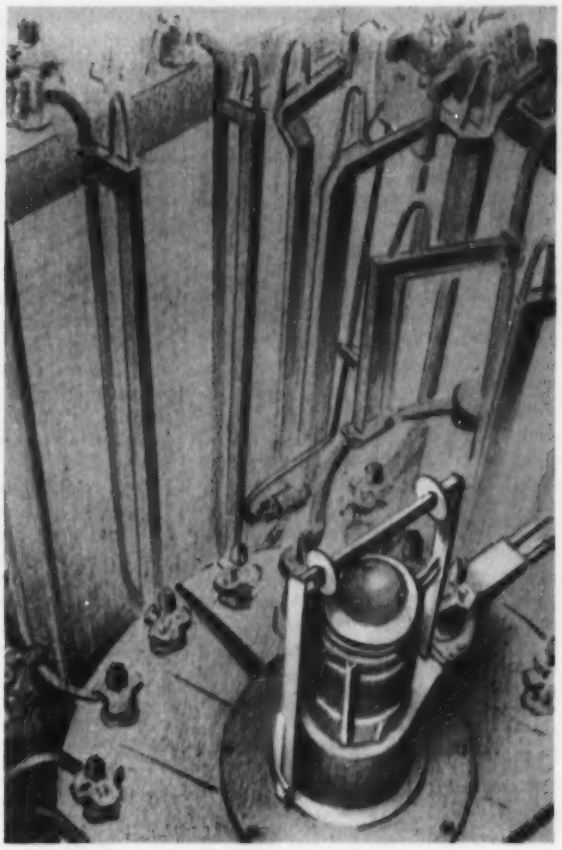
Equipment is maintained by an overhead crane. The crane operator is enclosed in a crane cab which also is heavily shielded as well as separated from line of sight viewing by a thick concrete wall. All viewing of the equipment and manipulation devices is done through a periscope.

In general, equipment which comprises a certain step of a process is contained in an enclosure or cell separate from other equipment. This segregation feature confines radioactivity in case of equipment failure or malfunctioning to a relatively small part of the plant—where concentrated maintenance

* Capture of a neutron does not immediately form plutonium. Instead U-239 forms, then this decays to neptunium, which decays to plutonium.



CANYONS are trench-like structures with equipment cells.



CELLS contain positioned equipment with jumpers.

efforts can be exerted with minimum concern for spread of intense radioactive contamination to equipment in adjacent cells.

The arrangement of the equipment is in a line from one end of the building where the processing begins, to the opposite end where the finished products emerge. Flow of process fluids between cells of equipment is from the cell to another completely shielded section of the plant called the pipe tunnel then back into the required cell.

A long building may be used where cells and pipe tunnel lie parallel. A shorter building may be used with the pipe tunnel lying parallel and between two rows of equipment cells. A third arrangement has a line of small cells of equal rectangular dimensions with all piping leaving the cells and entering the pipe tunnel through the narrowest wall of the cell.

Plants have been built employing each of these arrangements. The first and third permit the operations and controls to be conducted from only one side of a long building whereas the second arrangement requires operation and controls on both sides of a shorter building.

To assist in the understanding of this look at the cross section view of a plant. Note the crane, the crane cab and its shielding wall, pipe gallery, the tight fit of the equipment in the cells and the bends in the service piping which prevent a direct beam of radiation from entering any operating area.

All separations plants are long in comparison with their width. They comprise a deep trench-like structure, and are of extremely rigid construction. Probably they are as permanent as a feature of geology —a canyon. So they are called canyons.

In normal operations removable cover blocks close all cells. Except for the time at which the irradiated uranium is first brought into the plant for processing, blocks are only removed during maintenance or non-routine inspection operations of equipment.

Process Equipment Design

All process equipment, including reaction vessels, centrifuges, pumps, agitators, evaporators, control valves, liquid-liquid contactors and rotameters carrying radioactive solutions are assembled, connected and disconnected by manipulation from the crane.

All such equipment is accurately positioned in the cell with respect to adjacent equipment. And wall nozzles fitted with special flanges provide connections to all the required services for each piece of equipment.

The hook-ups for delivery of chemicals, power for agitators and pumps, air, steam and water as well as for instrumentation such as thermocouples, pressure sensing devices, liquid level and specific gravity measuring equipment, audio

equipment and lubrication for moving parts are all made by means of the so-called *remote connector.*

An assembly consisting of a length of pipe with a remote connector at each end is called a *jumper.* The connector heads are used to fasten the jumper tightly to a wall nozzle and a corresponding vessel nozzle by tightening a threaded screw with a remotely-controlled electrically-operated impact wrench. By turning the top nut, the three connector jaws are given linear motion, which loosens or tightens the connection. When tightening, the jaws engage the underside of the flange, exerting sufficient force to pull up tight. Such a device connects the vessel to a steam coil, for example, with the source of steam at the cell wall. Steam condensate is discharged through another jumper which contains the steam trap. This jumper connects the coil outlet nozzle on the vessel with a wall nozzle leading to a condensate header in the pipe tunnel. The header receives condensate from a number of vessels.

Standardization of Vessels

Standardization of vessel dimensions and orientation with respect to the wall nozzle pattern allow a single jumper design to serve for a number of positions in the canyon.

The jumper is balanced by counter weights and positioning of the lifting bale so that it can be lifted with the crane and lowered into position to precisely engage the connector heads with corresponding wall and vessel nozzles. Some jumpers have three heads which must be so engaged. For ease in maintenance, stacking or crossing of jumpers over one another is avoided wherever possible.

Prior to installation in the plant all vessels, process equipment and jumpers are assembled in the "mock-up" shop to check for mechanical fit. The mock-up shop has equipment mountings and dummy wall nozzles which, from a position and orientation standpoint, are identical with those in the separations plant. Such mock-up testing assures that equipment as fabricated will fit in the production plant without need for changing any jumpers. Any discrepancies, such as the position of vessel nozzles which show up in the mock-up shop are then corrected prior to installation in the plants. Close tolerances are, of course, required in fabrication of vessels and jumpers.

In general, most of the vessels and process equipment do not appear much different from those normally seen in industry. However, some vessels may be bathtub shaped instead of round in order to provide maximum capacity in the limited space of a cell. Instead of the usual flanges all vessels have the characteristic male nozzles to which the remote connector may be attached for the required hook-up for water, air, steam, chemical addition, instrumentation, etc. Motorized equipment must have nozzles for remote attachment of lines for power and lubrication.

For equipment such as evaporators, the pot, column, vapor-lines and condenser are generally separate pieces which are assembled remotely by the crane. Dowels and guides are used to assist in assembly and assure proper alignment of pieces during remote attachment.

Crane Design

The crane, with its single operator, performs all maintenance that can be done with any equipment in contact with radioactive materials. The extent of such maintenance is, however, quite limited.

Most of such work involves replacing failed or defective equipment. Components which are to be repaired are transported elsewhere. Essentially no disassembly and assembly of repaired equipment is done in the separations plant. By far the largest portion of the operating time of the crane is involved in charging dissolvers with the irradiated uranium which is to be processed.

Maintenance on the crane itself is done manually in an area at one end of the canyon. Because contamination is transferred to the crane parts from the cell equipment with which it comes in contact, crane maintenance is usually conducted with a large number of men working under radiation exposure time limits—which are sometimes as short as one minute.

The ventilation system in a separations plant is quite extensive. It is required to prevent radioactively contaminated fumes and dusts from drifting into personnel areas of the plant and also to retain and prevent similar escape of these fumes and dusts to the plant environs. By an extensive exhaust system the cells are kept under reduced pressure with respect to the rest of the canyon, particularly the personnel areas.

In addition, to retain activity, the vessels are maintained at pressures slightly lower than that of the cells. Air is drawn through the spaces between the cover blocks into the cells, out of the cells into the air tunnel, through a sand or glass-wool filter and then discharged from a tall stack. Gases which are evolved from the process vessels are drawn out and treated chemically to remove the biologically important fission products before discharge to the atmosphere.

Future Problems

So much for today's process engineering problems in the separations operation. What can be predicted for the future? The future, with its emphasis on power production from nuclear reactors, can be expected to present a host of new problems to the process engineer working in the field of fuel or separations processing.

The fuels themselves may be complex assemblies of a variety of materials, alloys and combinations; such as enriched uranium (high in U-235), plutonium, U-233 (from thorium), stainless steel, zirconium and ceramics. A high degree of chemical and mechanical process flexibility will be required in the separations plants to handle such a variety of materials.

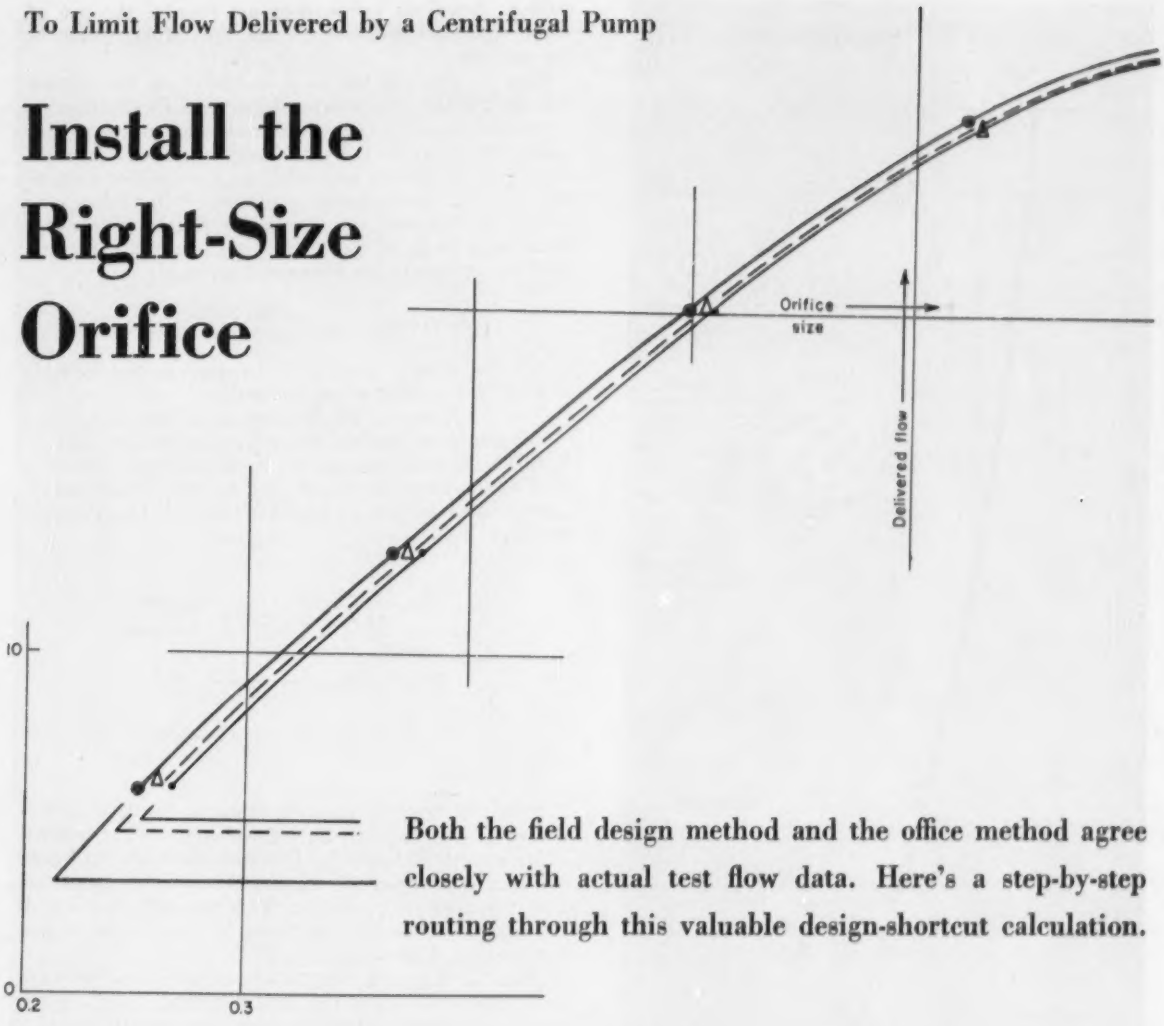
Although present operations are concerned with aqueous processes, alternate processes may be developed. Until then, the process engineer will be engaged in problems with the existing processes to improve safety, capacity and economics.

In the field of design, efforts will continue toward developing simpler equipment with more application of standardization and interchangeable and readily replaceable parts. Layout of equipment must continue to be considered to further improve accessibility and ease of replacement by remote methods. Application of improved materials of construction for vessels, gaskets and moving parts in this unique service will continue to receive attention.

This article is based on a paper presented at the Portland, Oregon, meeting of the ASME, Mar. 19, 1956.

To Limit Flow Delivered by a Centrifugal Pump

Install the Right-Size Orifice



Both the field design method and the office method agree closely with actual test flow data. Here's a step-by-step routing through this valuable design-shortcut calculation.

RALPH A. TROUPE and BERNARD M. GOODWIN, Northeastern University, Boston, Mass.*

OFTEN the practicing engineer faces the problem of limiting the flow from a centrifugal pumping system. Usually, such systems are designed to provide a higher capacity than is normally required.

However, in many cases it may be undesirable to operate at full flow. In fact, in some processes if a valve is carelessly or mistakenly opened too far, the overfeeding and resultant flooding of the system can cause time loss, necessitate product recycle and sometimes can result in complete loss of the product.

You might think of control instrumentation to guard against this hazard. But if no other control on the flow is needed, it is uneconomical and unnecessary to install control instrumentation.

The field engineer might attack the problem this way: Set the valve to give the desired flow and then remove the handle. But handles seem to be difficult to keep lost. Pliers, wrenches and the like will serve as handles. And finally, the valve itself doesn't always give satisfactory performance as an orifice.

*Meet your authors on p. 391.

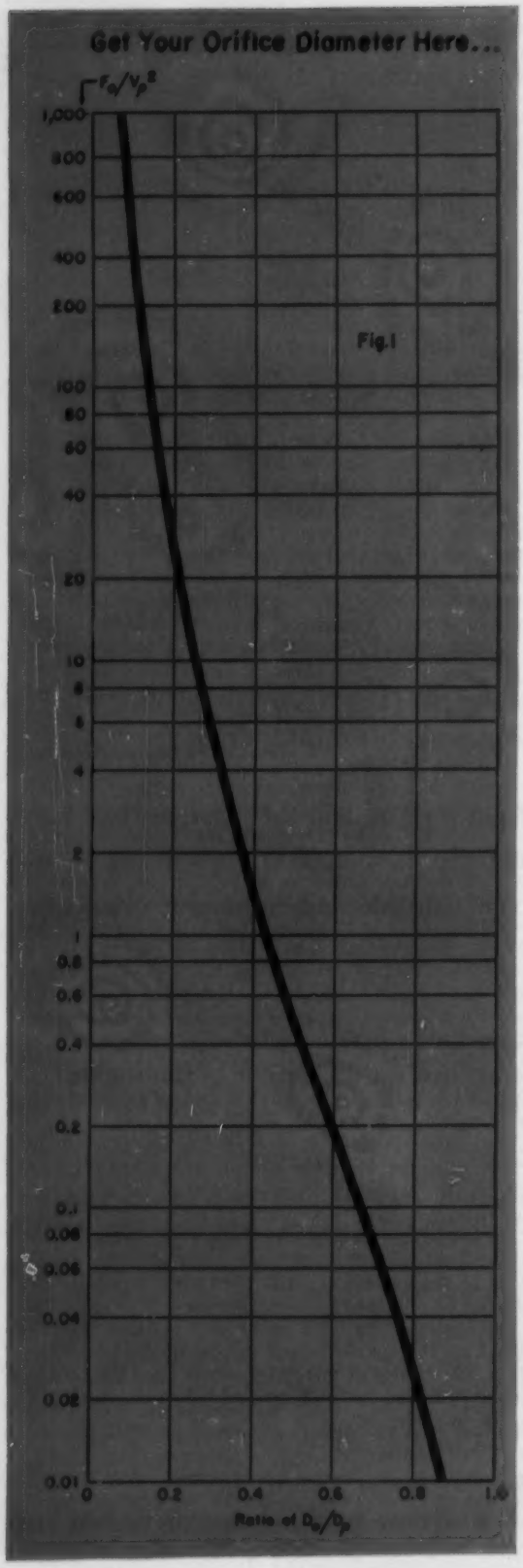
What then can the engineer do that will limit the flow satisfactorily, be economical and be relatively simple to design and install?

The answer is an orifice—correctly designed—placed between flanges wherever convenient on the discharge side of the pump, or as a cap orifice on the end of the line.

There are two methods for designing such an orifice. In the field, the engineer can calculate the friction heads in the system and the permanent pressure drop that can be obtained by inserting an orifice somewhere in the system. The office engineer can base his calculations on the characteristic curves of the centrifugal pump. The choice of method depends upon the accuracy needed and also on the time and information that are available.

The Field Design Method

It is not often that the engineer in the field has a pump characteristic curve available. The field design



method, described below, does not require the use of the characteristic curves for the centrifugal pump in the system.

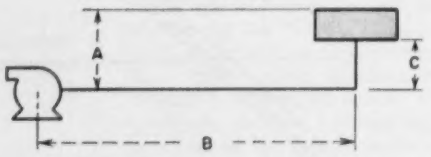
Step 1—Measure the rate of flow from the system and the discharge pressure of the pump when operating at full capacity (i.e., with the discharge valve wide open). Next, close the discharge valve until the desired rate of flow is obtained. At the desired rate of flow, record the discharge pressure of the pump.

Step 2—Convert the discharge pressure readings from psig. to ft. of the fluid being pumped. This can be done by using the following formula:

$$\text{Head in ft.} = \frac{\text{Psig.} \times 144}{62.4 \times \text{Specific Gravity}}$$

where the specific gravity to be used in the formula is that of the fluid being pumped.

Step 3—Measure the distance from the center line of the pump to the liquid source. Just which distance is this? This can sometimes be a point of confusion. For convenience we refer you to the sketch below. The distance we want to use has been labeled *A* in this sketch.



If this distance is positive (that is, the level of the source is higher than the center line of the pump), subtract the distance in ft. from each of the heads calculated in Step 2. If the distance is negative, add it to each of the heads. This calculation will give the head developed by the pump at the maximum and the desired flow rates.

Step 4—Measure the difference in levels between the liquid source and the final discharge point of the pumping system. (Note that we have not indicated a discharge point on our sketch above.) If the discharge point is higher than the source, subtract this difference in static head from the head developed by the pump at maximum capacity, as calculated in Step 3. If the discharge point is lower than the source, add the difference. This is the friction head for the system at full capacity.

Correction for velocity head is usually small and we will neglect it in our analysis. In the procedure that we are outlining here we will assume that there is no difference in pressure between the ends of the system.

Step 5—We now are ready to calculate a value for F_2, the friction head at the desired capacity. We can use the following formula:

$$F_2 = F_1\left(\frac{G_2}{G_1}\right)^{1.85}$$

where F_1 is the friction head calculated in Step 4; and G_1 and G_2 are the rates of flow at full capacity and the desired capacity, respectively.

Step 6—To the friction head calculated in Step 5, add the difference in static heads in ft. (measured in

These Nomographs Will Speed Your Calculations...

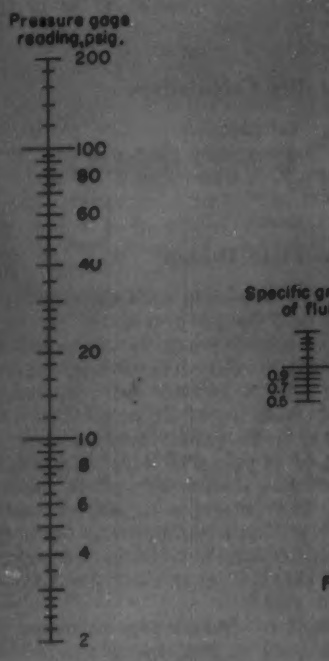
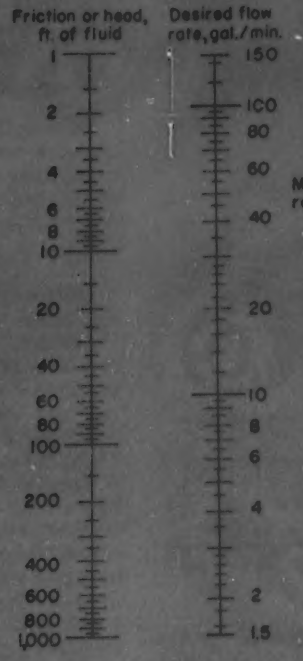


Fig. 2



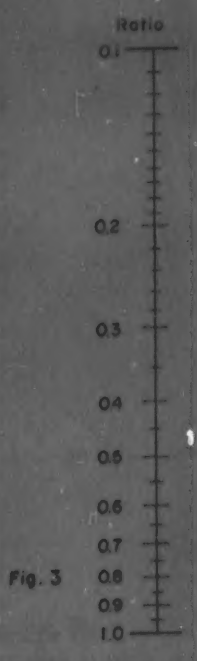
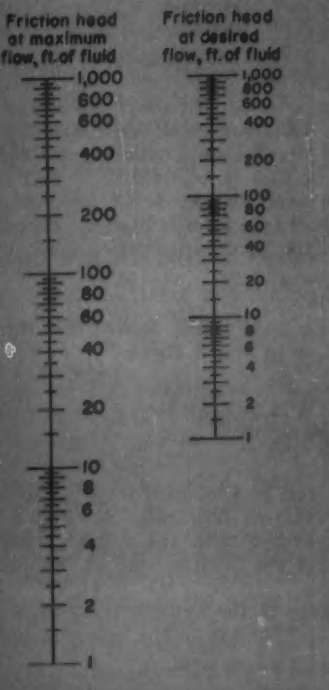


Fig. 3



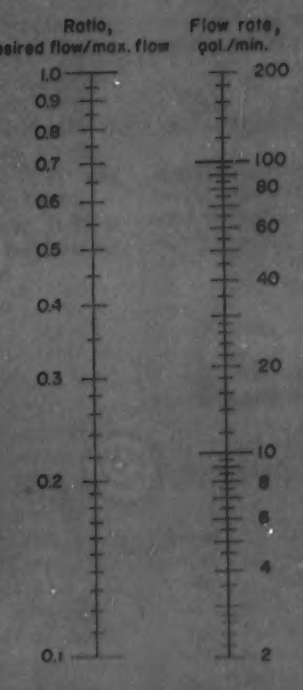


Fig. 4

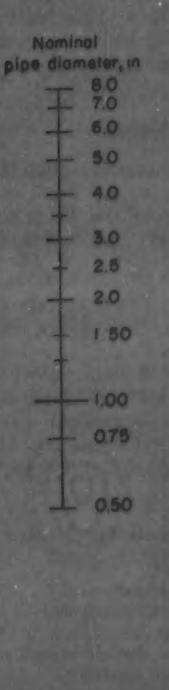


Fig. 5

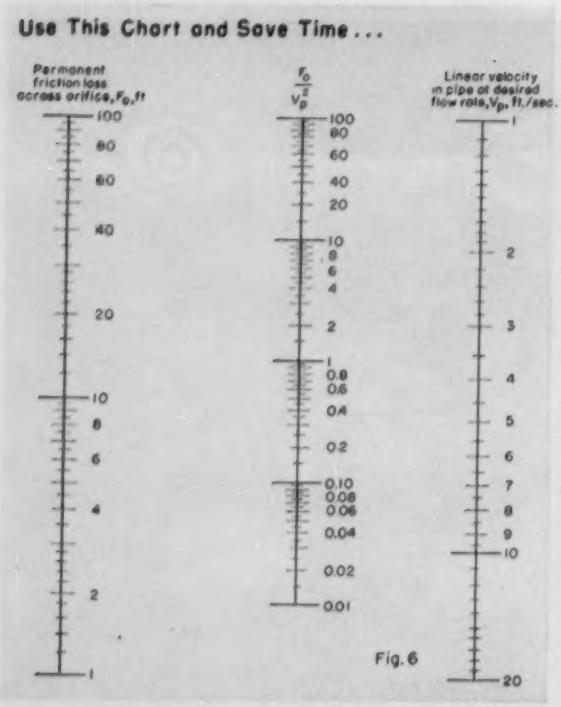


Fig. 6

Step 4). This will give the total resistance of the system when it delivers the desired flow.

The difference between this total resistance and the head developed by the pump at the desired capacity (Step 3) will give the resistance, F_o, which must be furnished by the orifice. This resistance is also measured in ft. of the fluid being pumped. It is the permanent loss in head caused by the orifice.

How to Size the Orifice

We are now prepared to select the orifice that will give us the resistance, F_o. First calculate the linear velocity, in ft./sec., of the fluid flowing in the pipe into which we'll insert the orifice. The following formula applies:

$$V_p = \frac{G\,(4)\,(144)}{(7.48)\,(\pi)\,(D_p)\,(60)}$$

where V_p is the linear fluid velocity in ft./sec.; G is the rate of flow in gpm.; and D_p is the actual inside diameter of the pipe in inches.

In Fig. 1 we have plotted the friction due to the orifice, F_o, divided by the square of the linear velocity in the pipe, V_p, vs. the ratio of orifice diameter to pipe diameter. Now that we have evaluated V_p, we can square it and divide into the value of F_o found in Step 6 above. Fig. 1 then gives the corresponding value of D_o/D_p.

Multiply this value by the pipe diameter to arrive at the diameter of the orifice.

Nomenclature (Consistent Units)

D_o	Orifice diameter
D_p	Actual inside pipe diameter
F_o	Resistance due to the orifice
F_1	Friction head at full capacity
F_2	Friction head at desired capacity
G_1	Flow rate at full capacity
G_2	Flow rate at desired capacity
V_p	Linear velocity of fluid in the pipe

Nomographs Simplify Calculations

To simplify your calculations further, we have included a series of nomographs that will save design time. They are Figs. 2, 3, 4 and 5 on p. 201 and Fig. 6 on this page.

Sample Problem: Field Design

Let's work through a sample problem showing the application of the field design procedure.

Problem—A centrifugal pump is connected to a system made up of 1-in. Schedule 40 iron pipe. The maximum system output is 30.5 gpm., corresponding to a discharge pressure of 21 psig. We want to limit the flow rate to 20 gpm., corresponding to a discharge pressure of 24 psig. The liquid in the system is water at 68 F. Suction level is 3 ft. above the center line of the pump. The difference in suction and discharge levels is 10 ft., with the discharge level being higher than the liquid source. What is the right-size orifice to install in this system to limit the flow to the desired rate of 20 gpm?

Solution—We want to convert the discharge pressure readings into head of fluid being pumped.

$$\text{Head in ft. (maximum)} = \frac{21 \times 144}{62.4 \times 1.0} = 48.5$$

$$\text{Head in ft. (desired)} = \frac{24 \times 144}{62.4 \times 1.0} = 55.5$$

The same values can be obtained by using the nomograph on p. 201 (Fig. 2).

Since the suction level is 3 ft. above the center line of the pump, the maximum head developed by the pump is 48.5—3.0 or 45.5 ft. Similarly, the desired head is 55.5—3.0 or 52.5 ft. of fluid.

The difference in level between suction and discharge is 10 ft. and the discharge level is higher. Therefore, we subtract to get the maximum friction head.

$$\text{Friction head (maximum)} = 45.5 - 10 = 35.5 \text{ ft.}$$

To get the friction head at the desired flow rate we use the formula given in Step 5 above.

$$F_2 = 35.5\left(\frac{20}{30.5}\right)^{1.85}$$

$$F_2 = 16 \text{ ft.}$$

This calculation can be simplified by using Figs. 3 and 4. Find the ratio of flow rates on Fig. 3 and align this ratio together with the friction head at maximum flow to get the friction head at the desired flow rate on Fig. 4.

The total resistance in the system, then, is 16 plus 10 or 26 ft. The friction due to the orifice should be

$$F_o = 52.5 - 26 = 26.5 \text{ ft.}$$

Our next step is to find the linear velocity in the pipe, V_p.

$$V_p = \frac{(20)\ (4)\ (144)}{(7.48)\ (3.14)\ (1.05)\ (1.05)\ (60)}$$

$$V_p = 7.44 \text{ ft./sec.}$$

Then,

$$F_o/V_p^2 = 26.5/(7.44)^2 = 0.480$$

These calculations can be simplified by using Fig. 5 on p. 201 and Fig. 6 on p. 202. From Fig. 1 we find that $D_o/D_p = 0.5$. Then,

$$D_o = (0.5)\ (1.05) = 0.525 \text{ in.}$$

The Office Engineer's Method

When a centrifugal pump is purchased, it is usually accompanied by a set of characteristic curves that relate head and capacity. We have shown such a plot in Fig. 7.

If the office engineer has these curves available, he can use the following method for sizing the orifice.

Step 1—On the head-capacity curve for the centrifugal pump, draw a horizontal line at the head that corresponds to the difference in levels between the source and the discharge points (static head).

Step 2—Calculate the head due to friction for the piping system (as ft. of fluid) at various flow rates. This can be done by methods outlined in many texts and handbooks, or from friction tables. Plot these data on the head-capacity diagram for the pump. If this curve is drawn using the static head line as a base, the resultant curve will represent the total head opposing flow for each capacity.

Here again, velocity heads and pressure differences between the ends of the system have been neglected for the purpose of simplifying our discussion.

Step 3—Locate the desired flow rate on the abscissa of the diagram. Go vertically upward from this point to the curve that represents the total head opposing flow. In a similar manner, obtain the corresponding head from the head-capacity curve for the pump.

Step 4—Get the difference between the two heads found in Step 3. This difference will be the resistance, F_o, which must be created by an orifice to be installed in the line.

Step 5—Now refer to the field design procedure and the rest of the calculations will be identical.

Sample Problem: Office Design

To illustrate the office design method we will work out the same sample problem as above. Refer to Fig. 7 which shows the head-capacity curve for the centrifugal pump.

Step 1—The static head for the system is represented by the horizontal line at $H = 10$.

Step 2—The piping friction curve is represented by the line originating at $G = 0$, $H = 10$, and passing through points C and A. Since it is drawn on the static head line as a base, it represents the total resistance to flow.

Step 3—The desired flow rate is 20 gpm. The total resistance to flow for the system at this rate is located at point C and has the value of 26 ft. The head developed by the pump at this flow rate is located at point B and had the value of 53 ft.

Step 4—The resistance which must be furnished by the orifice is equal to

$$F_o = 53 - 26 = 27 \text{ ft.}$$

Office Design Method...

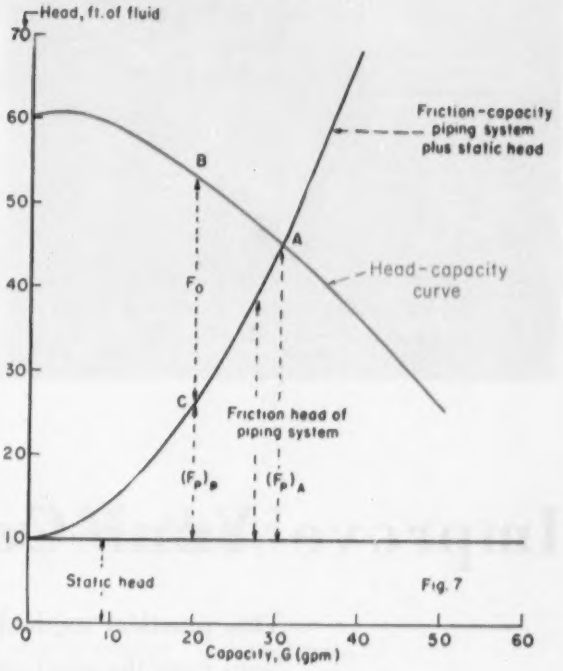


Fig. 7

Step 5—The velocity in the pipeline, V_p, is equal to 7.44 ft./sec. Then,

$$F_o/V_p^2 = 27/(7.44)^2 = 0.488$$

And from Fig. 1,

$$D_o/D_p = 0.5$$

or,

$$D_o = (0.5)\ (1.05) = 0.525 \text{ in.}$$

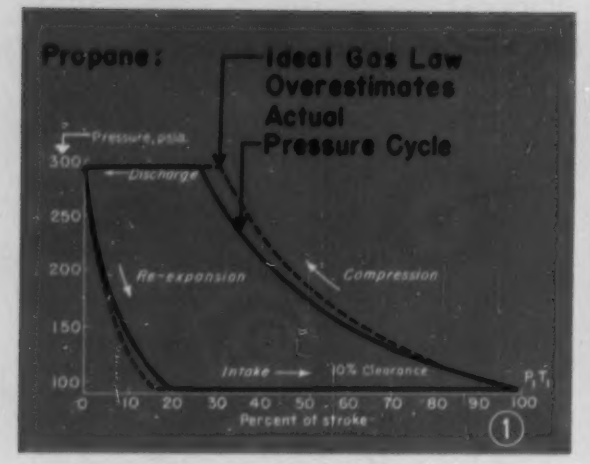
This is the same size that we arrived at by using the field design method.

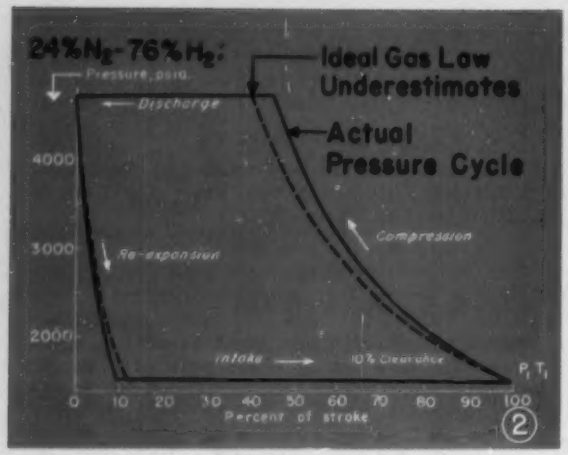
Calculated Checks Experimental

The validity of these calculation methods was investigated by the authors in a series of laboratory tests. For several rates of flow and for several types of orifices, we measured the experimental flow delivered through the orifices and compared the experimental values with values calculated using both the field design and office design methods. The check was quite close. We have listed some typical values in the table below. In addition, the illustration on p. 199 indicates the accuracy of the methods.

Calculated Sizes Check Experimental

Rate of Flow Gpm.	Orifice	Actual Orifice Diameter, In.	Calculated Orifice Diameter, In. (Field)	Calculated Orifice, Diameter, In. (Office)
30	None	.....	.....	.....
6.0	Square edge	0.250	0.256	0.257
12.9	Sharp edge	0.375	0.380	0.381
20.1	Sharp edge	0.500	0.509	0.510
25.4	Square edge	0.625	0.640	0.637
18.8	Cap type	0.504	0.485	0.489





Improve Your Compressor Design

This practical method takes into account the all-important deviations from the ideal gas law; gives you accurate design information.

W. HARTWICK, Cooper-Bessemer Corp., Mt. Vernon, Ohio*

Non-ideal gas behavior greatly affects the performance of reciprocating compressors. To be successful any compressor design should take these effects into account. Unfortunately, this is not always the case.

The following will show various results that gas deviation can produce. And we will present a calculation method for including these effects in design calculations involving gases for which inadequate thermodynamic data are available.

Accurate calculations can be simply and quickly made from adequate thermodynamic information. However, such data are frequently unavailable for gas mixtures encountered and pressure ranges covered in many applications. In such cases it's necessary to resort to methods based on generalized gas properties.

We've demonstrated the reliability of the proposed generalized calculation method by applying it to twenty-seven compression cycles, involving nine gases, and comparing results to those from thermodynamic data. Calculations based on ideal gas behavior are also included to reveal the errors involved.

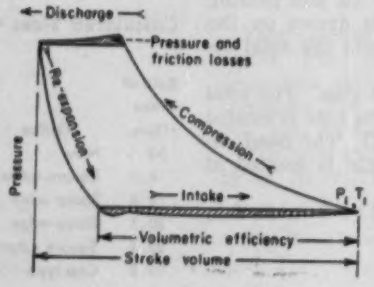
* Meet your author on page 392.

Since there is confusion about the physical significance of departure from ideal gas behavior on compressor capacity and power requirements, we will first try to clarify these points.

Performance Criteria

Performance of reciprocating compressors can best be studied by reference to a pressure-volume diagram such as shown below. The basic criteria of performance are work required and quantity handled.

Total work required equals the sum of that necessary to overcome piston, piston ring, and piston rod friction plus that represented by the diagram area. The diagram can

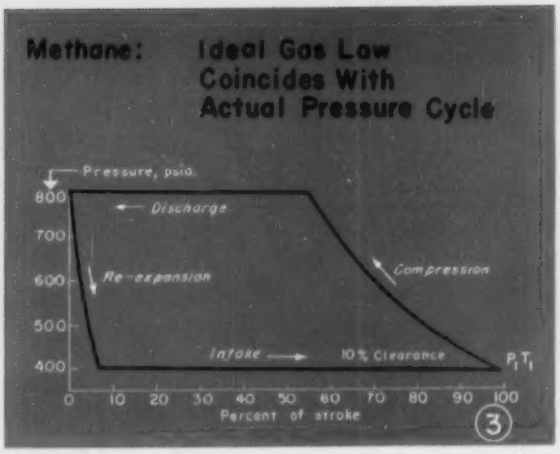


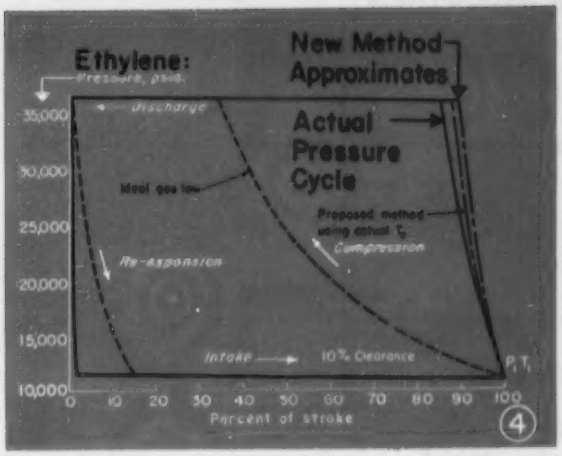
be separated into the *basic cycle*, which is included between the terminal pressure p_1 and p_2, and the *compressor pressure losses*. Compressor pressure and friction losses are not readily calculated and must be determined experimentally. For a particular compressor design these losses can be combined in a *loss factor, F*, which varies with compression ratio and relates total to basic work per cycle with satisfactory accuracy as follows:

$$\text{total work/cycle} = \text{basic work/cycle} \times F. \quad (1)$$

Compressor cylinder pressure and friction losses are ordinarily a relatively small portion of the total work requirement. Furthermore, the effect of gas deviation on these losses is small for conditions normally encountered. For all practical purposes then, investigation of the effect of gas deviation on work required can be confined to the basic cycle.

Volume handled, measured at inlet conditions of p_1 and T_1, is represented by volumetric efficiency. Thus, deviation affects inlet volume only to the extent that it influences the re-expansion path of the basic cycle. Pounds handled is a function





With New Calculation Method

of both inlet volume and specific volume at inlet conditions.

Thus the effect of gas deviation on compressor performance—work required and quantity handled—can be adequately covered by investigation of the basic cycle.

Isentropic Compression

It's generally accepted that the compression and re-expansion paths of the compressor cycle are accomplished isentropically (perfectly reversible adiabatic). For ideal gases these paths are dictated by the relationship pv^k = constant, where p is pressure, v is specific volume and k is ratio of specific heats. The basic horsepower requirement for isentropic compression of ideal gases is:

$$\text{Basic hp.} = \frac{144}{33{,}000}\left(\frac{k}{k-1}\right)(p_1V_1)\left[\left(\frac{p_2}{p_1}\right)^{(k-1)/k} - 1\right] \quad (2)^1$$

Here V_1 represents quantity handled, measured in cubic feet/min. at inlet conditions p_1 and T_1, and can be determined as follows:

$$V_1 = Pd \times Ev_1 \quad (3)$$

$$\text{Where } Ev_1 = 1 - C\left[\left(\frac{p_2}{p_1}\right)^{1/k} - 1\right] \quad (4)^2$$

$$\text{or } Ev_1 = 1 - C\left(\frac{v_1}{v_2} - 1\right) \quad (5)$$

Note that Eq. 5 also applies to real gases if actual specific volumes are used.

Since ideal gases are currently under consideration, V_1 can be expressed as a quantity V_o at any pressure p_o, in accordance with the following constant temperature relationship for perfect gases as shown below:

$$p_1V_1 = p_oV_o \quad (6)$$

Eq. 2 then becomes:

$$\text{Basic hp.} = \frac{144}{33{,}000}\left(\frac{k}{k-1}\right)(p_oV_o)\left[\left(\frac{p_2}{p_1}\right)^{(k-1)/k} - 1\right] \quad (7)$$

Horsepower curves computed from Eq. 7 modified by appropriate loss factors and employing a pressure base, p_o, of 14.4 psia. and a standard quantity base, V_o, of 100 cu. ft./min. or one million cu. ft./day (695 cfm.) are widely used in the compressor industry. Such curves are, however, valid only for isentropic compression of ideal gases.

Deviation From Ideal

According to the thermodynamic laws of ideal gases, the following relationship, known as an equation of state, holds true:

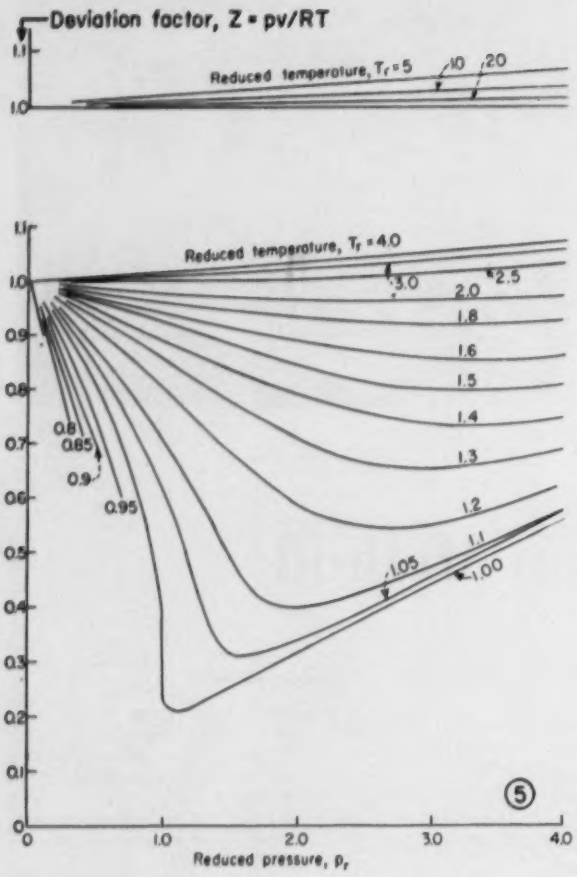
$$144\,pv = RT \quad (8)^3$$

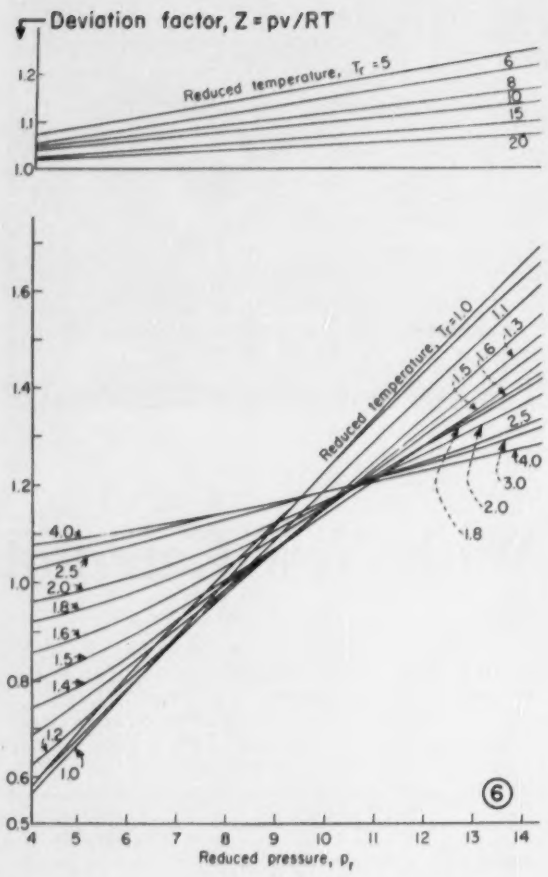
$$\text{Where } R = 1544/M \quad (9)^4$$

Below is a similar equation of

Nomenclature

A, B	constants in Eq. 14
Btu.	British thermal unit
C	compressor clearance expressed as a fraction of displacement per stroke
c_p	specific heat at constant pressure
c_v	specific heat at constant volume
Cfm.	cu. ft./min.
Ev_1	suction volumetric efficiency expressed as a fraction of stroke
F	loss factor
H	enthalpy, Btu./lb.
Hp.	horsepower
M	molecular weight
M_{cp}	molal heat capacity at constant pressure, Btu./lb. mole /Rankine
p	pressure, psia
Pd	compressor piston displacement, cu. ft./min.
R	gas constant, ft. lb./lb./Rankine
T	temperature, Rankine unless otherwise noted
V	quantity handled, cu. ft./min.
W	quantity handled, lb./min.
Z	deviation (compressibility) factor
f_x	volume fraction of component x
f_y	volume fraction of component y
k	ratio of specific heats; compression exponent for the ideal gas expression pv^k = constant. $k = c_p/c_v$
k'	compression exponent for the real gas relationship $pv^{k'}$ = constant
v	specific volume, cu. ft./lb.
Subscripts	
c	critical property
x, y	components of a two-component gas mixture
0	measuring condition
1	initial state (inlet condition)
2	final state (discharge condition)





state for gases which deviate from ideal behavior:

$$144\ pv = ZRT \qquad (10)^{*}$$

It should be emphasized that in Eq. 10 the deviation (compressibility) factor, *Z*, is a general correction to the ideal equation of state and not necessarily a volume correction. It may be convenient to consider perfect gases as conforming to a special case of Eq. 10 in which *Z* equals unity.

Perhaps the best way to study the effect of deviation on gas compression is to compare performance as determined from reliable thermodynamic data of various gases to that predicted from ideal gas relationships. The examples which follow will illustrate this.

Propane — Determine both by ideal gas laws and by means of thermodynamic data* the capacity and power requirement of a compressor with 10% clearance and a piston displacement of 1000 cfm. compressing propane from 100 psia. and 80 F. to 300 psia.

Geometrically correct pressure-volume diagrams of the basic cycles for the ideal and actual* cases are shown in Fig. 1, and values of pertinent items of comparison are below:

	Actual	Ideal
Volumetric efficiency	0.802	0.835
Cfm. @ inlet conditions	802	835
Specific volume at inlet, cu. ft./lb	1.160	1.314
Pounds handled/min	691	635
Basic horsepower required	388	425
Horsepower/lb	0.561	0.670

Thus, you can see:

• Actual power requirement is less than predicted by ideal gas laws. This is the influence of deviation on compression and re-expansion lines.

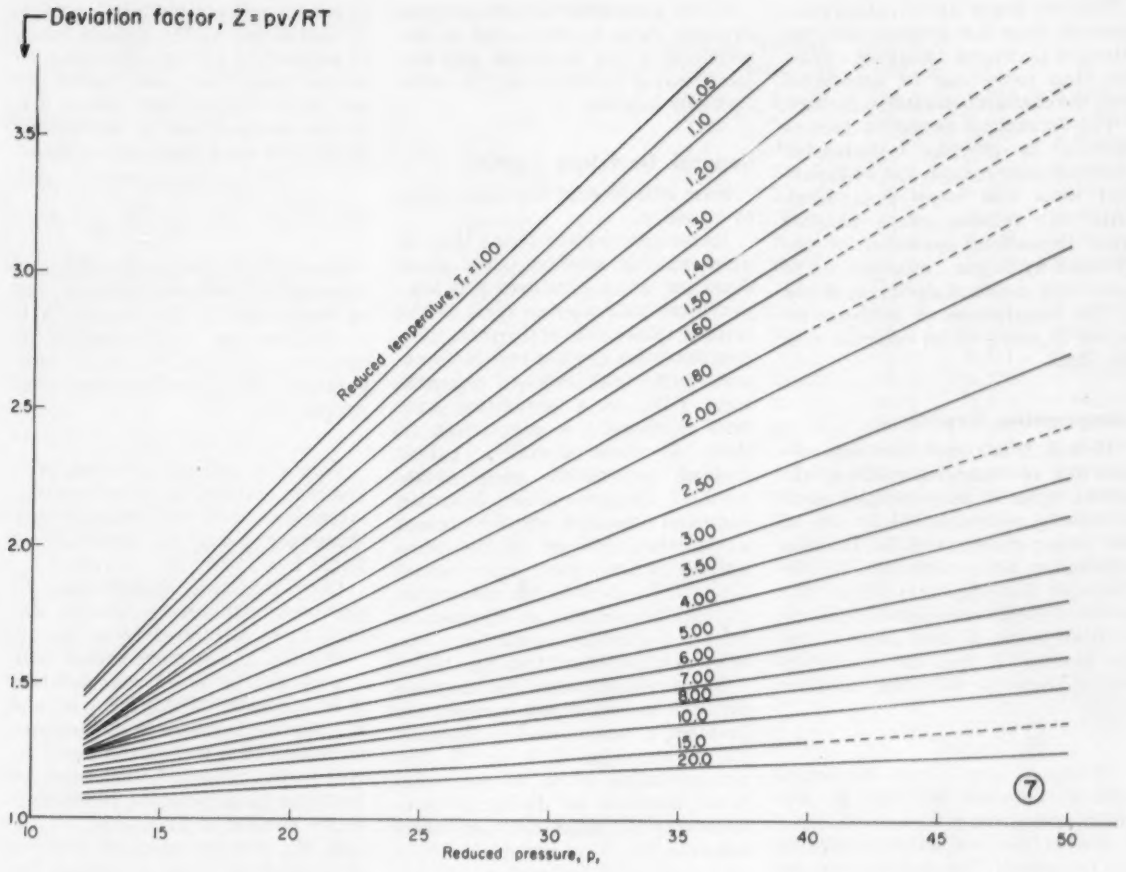
• Actual volumetric efficiency and, therefore, inlet volume is less than ideal because of the effect of deviation on the re-expansion path.

• Although actual inlet volume is less than the ideal, the pounds handled is greater because of deviation existing at inlet conditions.

It's significant that the influence of cylinder clearance on volumetric efficiency (Eqs. 4 and 5) makes clearance a factor in the relative values of ideal and actual pounds handled. In the propane problem based on 10% clearance, actual pounds handled were 109% of the ideal figure and actual power required was 91.3% of ideal. These relationships become 102% and 85.4% respectively when calculated for a compressor with 20% clearance. Horsepower required per pound handled, however, is independent of compressor clearance.

Nitrogen-Hydrogen Mixture — The influence of deviation on the compression of a 24%-76% volume mixture of nitrogen and hydrogen at relatively high pressures is practically opposite that of propane.

* Thermodynamic properties taken from the literature and values calculated from them will be referred to as actual properties and values.



Compute the capacity and power requirement of a compressor with 10% clearance and a piston displacement of 10 cfm. compressing a 24%-76% volume mixture of nitrogen and hydrogen isentropically from 1600 psia. and 80 F. to 4800 psia. both by ideal gas relationships and by use of thermodynamic data.[7]

Results of this example are summarized in Fig. 2 and in the following tabulation:

	Actual	Ideal
Volumetric efficiency	0.902	0.881
Cfm. @ inlet conditions	9.02	8.81
Specific volume at inlet, cu. ft./lb	0.466	0.438
Pounds handled/min	19.35	20.12
Basic horsepower required	85.3	79.4
Horsepower/lb	4.40	3.94

The following conclusions can be drawn from this comparison:

- Actual power requirements exceed the ideal.
- Actual volumetric efficiency exceeds the ideal.
- The effect of deviation on volumetric efficiency is overbalanced by deviation at inlet conditions so that actual capacity expressed in pounds is less than predicted by ideal gas relationships.

Here, again, the effect of deviation on the actual compression and/or re-expansion paths lead to the first two conclusions. The combined effect of deviation on the re-expansion line and deviation existing at inlet conditions dictates the third conclusion.

Methane — The following table and Fig. 3 compare the performance as dictated by ideal gas laws with that based on thermodynamic data[8] for a compressor with 10% clearance and a piston displacement of 500 cfm., compressing methane from 400 psia. and 80 F. to 800 psia:

	Actual	Ideal
Volumetric efficiency	0.930	0.930
Cfm. @ inlet conditions	465	465
Specific volume at inlet, cu. ft./lb	0.861	0.903
Pounds handled/min	540	515
Basic horsepower required	611	611
Horsepower/lb	1.133	1.188

Conclusions to be drawn from this comparison are:

- Since compression and re-expansion lines of the ideal and actual cycles coincide, power requirements are equal.
- Volumetric efficiencies are equal because re-expansion lines follow identical paths.
- The pounds handled is greater in the actual case due solely to deviation at inlet conditions.

Developing the Method

Further analysis of the isentropic compression and re-expansion lines of the actual cycles in the preceding examples shows the following deviations to exist at various pressure levels on the paths:

Propane		Nitrogen-Hydrogen		Methane	
Psia.	Z	Psia.	Z	Psia.	Z
100	0.884	1600	1.061	400	0.954
160	0.838	2400	1.092	500	0.953
220	0.800	3500	1.129	600	0.955
300	0.765	4800	1.172	700	0.957

Thus the departure of actual compression lines for propane and the nitrogen-hydrogen mixture from the ideal paths can be associated with the changing deviation factors.

The decreasing deviation factors existing in propane compression produced compression and re-expansion lines less steep than ideal, while the reverse effect resulted from increasing deviation of the nitrogen-hydrogen mixture. The practically constant deviation shown in the compression of methane resulted in paths which coincide with the ideal.

Compression Exponent

It was found that the compression and re-expansion paths of the actual cycles in the examples could be closely approximated by use of the proper exponent in the familiar expression $pv^{k'} = \text{constant}$. To distinguish this exponent from that which dictates compression and expansion paths of ideal gases it will be denoted k' and can be determined from the following relationship:

$$p_1 v_1^{k'} = p_2 v_2^{k'} \qquad (11)$$

Where v_1 and v_2 are the actual specific volumes existing at terminal pressures p_1 and p_2.

Points lying on paths dictated by the exponent k' are indicated on the solid lines in Figs. 2, 3, and 1. In all cases these paths show excellent agreement with those based on the thermodynamic data.

In the absence of reliable thermodynamic data, v_1 and v_2 can be determined, k' can be found, and any compression problem can be satisfactorily handled.

General Deviation Curves

Now let's look at the calculation of v_1 and v_2.

Investigators have found that all gases exhibit approximately equal deviation when pressures and temperatures bear a given ratio to the critical values. Several curves plotting deviation against reduced pressure, p/p_c, with reduced temperature, T/T_c, as a parameter have been published. A comparison of three of these deviation curves showed remarkably good agreement.[9, 10] The generalized deviation curves in Figs. 5, 6, and 7 represent a smoothed average of the three sources which were investigated and will be used in the calculation of specific volume at compressor inlet and discharge conditions. For more detailed charts see ref. 10.

Since inlet pressure and temperature are known in any compression problem, v_1 can be readily found by Eq. 10 and Figs. 5, 6, and 7. The determination of v_2 is somewhat more involved as discharge temperature, T_2, must first be established.

Discharge Temperature

Published methods of calculating T_2 for real gases[11, 12] are somewhat laborious and are definitely limited in application by the narrow range of supporting curves. Moreover, as we will show later, end results are not much better than when discharge temperature is determined by the following ideal gas equation:

$$T_2 = T_1 (p_2/p_1)^{(k-1)/k} \qquad (12)^{12}$$

$$\text{Where } k = c_p/c_v = \frac{M_{cp}}{M_{cp} - 1.987} \qquad (13)^{12}$$

Approximate values of molal heat capacity at constant pressure can be determined by Eq. 14, which is a straight line approximation of published values of M_{cp} versus temperature. M_{cp} is found at inlet temperature, T_1.

$$M_{cp} = A + BT \qquad (14)^{12}$$

Values of critical pressure, critical temperature, A, B, and molecular weight of several commercially important gases are included in Table I.

Once discharge temperature, T_2, has been established, specific volume, v_2, is calculated from Eq. 10.

When a gas mixture rather than a pure gas is under consideration it is suggested that p_c, T_c, M, and M_{cp} for the mixture be determined by means of a method proposed by Kay.[14] T_2, v_2, and v_2 can then be found as for a pure gas. Essentially Kay's method of finding p_c, T_c, M, and M_{cp} for the mixture consists of weighting these properties for each component according to its volume fraction and adding these partial values. Calculation of the critical pressure for a two-compo-

Data Sources For Table II

[a] "Tables of Thermodynamic Properties of Ammonia," *Bureau of Standards Circular No. 142*, (April, 1923).

[b] Pringle, W., Jr., L. R. Greenhaus, and R. York, Jr., *Chem. Eng. Prog.*, **44**, (November 1948) pp. 863-868.

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[h] Matthews, C. S., and C. O. Hurd, *Trans. AIChE*, **42** (February, 1946) pp. 55-78.

[i] Stearns, W., and Emanuel J. George, *Ind. and Eng. Chem.*, **35** (May, 1943) pp. 602-607.

[j] Keenan, J. H., and Frederick G. Keyes, *"Thermodynamic Properties of Steam,"* John Wiley and Sons, Inc., New York, 1936.

Comparing Calculated Compression Cycles—Table II

Gas	Press., psia. p_1	Press., psia. p_2	T_1 °F	v_1, cu. ft./lb. Actual	v_1, cu. ft./lb. Prop.	v_1, cu. ft./lb. Ideal
Ammonia[a]	95	290	100	3.491	3.496	3.71
	39.4	240	11	7.148	7.18	7.54
	110	260	100	2.981	2.99	3.21
Butane[b]	117.7	515	260	1.019	1.012	1.128
	117.7	294	220	0.940	0.927	1.066
	294	514	360	0.431	0.434	0.515
Carbon Dioxide[c]	426	1678	57.9	0.240	0.2373	0.296
	710	1283	76.6	0.1282	0.1254	0.1845
	142.2	455	35.6	0.800	0.790	0.850
Ethane[d]	400	800	70	0.3484	0.342	0.472
	159.9	400	−20	0.7983	0.790	0.983
	85.1	250	−55	1.488	1.493	1.696
Ehtylene[e]	11,760	56740	100	0.0320	0.0317	0.0183
	4410	14700	80	0.0369	0.0368	0.0468
Ethylene[f]	720	2540	50	0.1200	0.1220	0.271
Hydrogen-Nitrogen[g]	1600	4800	80	0.4655	0.475	0.438
	4000	15000	100	0.2126	0.2182	0.1818
	10,000	15000	100	0.1069	0.1097	0.0727
Methane[h]	400	800	80	0.861	0.867	0.903
	500	1500	80	0.681	0.685	0.722
	250	1000	60	1.344	1.353	1.391
Propane[i]	100	300	80	1.16	1.139	1.314
	60	160	30	1.81	1.782	1.985
	160	300	90	0.670	0.666	0.835
Water[j]	800	2700	570	0.6416	0.646	0.767
	180	365	440	2.813	2.82	2.98
	465	1600	490	1.062	1.067	1.217

nent mixture, for instance, would be as follows:

$$p_c \text{ mixture} = f_x \times p_{cx} + f_y \times p_{cy} \quad (15)$$

Power and Capacity

Once v_1 and v_2 are known, inlet cfm., V_1, can be found from Eqs. 5 and 3; and the compression exponent, k', can be calculated from Eq. 11.

Inlet cfm. can be referred to any desired pressure and temperature (p_o, T_o) by means of the real gas relationship:

$$\frac{p_1 V_1}{Z_1 T_1} = \frac{p_0 V_0}{Z_0 T_0} \quad (16)$$

Apply Eq. 17 to convert inlet cfm. to capacity expressed in lb./min.

$$W = V_1/v_1 \quad (17)$$

Horsepower required is determined from Eq. 18—simply a modified version of the ideal gas equation wherein k is replaced by k'.

$$\text{Basic hp.} = \frac{144}{33{,}000} \times \frac{k'}{k'-1} (p_1 V_1) \left[\left(\frac{p_2}{p_1} \right)^{(k'-1)/k'} - 1 \right] \quad (18)$$

Summary of the Method

A summary of steps in the proposed method follows:

1. Find specific volume at inlet, v_1, by means of Eq. 10 obtaining Z from Figs. 5, 6, or 7 and calculating R from Eq. 9. See Table I for critical pressure and temperatures and molecular weights. For gas mixtures apply the principle illustrated in Eq. 15 to find p_c, T_c, M, and M_c, and then proceed as for a pure gas.

2. Find discharge temperature, T_2, from Eq. 12 using supporting Eq. 13 and 14. See Table I for values of A and B in Eq. 14.

3. Calculate specific volume at discharge, v_2, as shown in the first step.

4. Determine inlet volume using Eqs. 5 and 3. Apply Eq. 16 to express volume handled at other conditions of pressure and temperature

Gas Properties—Table I

Gas	Formula	Molecular Weight	Critical Press., Psia.	Critical Temp, °R	A	B
Air	——	28.97	546.7	238.4	6.737	0.000397
Ammonia	NH_3	17.03	1638	730.1	6.219	0.004342
Carbon dioxide	CO_2	44.01	1073	547.7	6.075	0.005230
Carbon monoxide	CO	28.01	514.4	241.5	6.780	0.000327
Hydrogen	H_2	2.016	305.7	72.47	6.662	0.000417
Hydrogen sulfide	H_2S	34.07	1306	672.4	7.197	0.001750
Nitrogen	N_2	28.02	492.3	226.9	6.839	0.000213
Oxygen	O_2	32.00	730.4	277.9	6.459	0.001020
Sulfur dioxide	SO_2	64.06	1142	774.7	——	——
Water	H_2O	18.02	3200	1165	7.521	0.000926
Methane	CH_4	16.04	673.1	343.2	4.877	0.006773
Acetylene	C_2H_2	26.04	911.2	563.2	6.441	0.007583
Ethene	C_2H_4	28.05	748.0	509.5	3.175	0.013500
Ethane	C_2H_6	30.07	717.2	549.5	3.629	0.016767
Propene	C_3H_6	42.08	661.3	656.6	4.234	0.020600
Propane	C_3H_8	44.09	617.4	665.3	3.256	0.026733
1-Butene	C_4H_8	56.11	587.8	752.2	5.375	0.029833
Isobutene	C_4H_8	56.11	580.5	756.7	6.066	0.028400
Butane	C_4H_{10}	58.12	550.7	765.3	6.188	0.032867
Isobutane	C_4H_{10}	58.12	543.8	732.4	4.145	0.035500
Amylene	C_5H_{10}	70.13	593.7	853.9	7.980	0.036333
Isoamylene	C_5H_{10}	70.13	498.2	836.6	7.980	0.036333
Pentane	C_5H_{12}	72.15	485.0	846.7	7.739	0.040433
Isopentane	C_5H_{12}	72.15	483.5	829.7	5.344	0.043933
Neopentane	C_5H_{12}	72.15	485.0	822.9	4.827	0.045300
Benzene	C_6H_6	78.11	703.9	1011	−0.756	0.038267
Hexane	C_6H_{14}	86.17	433.5	914.3	9.427	0.047967
Heptane	C_7H_{16}	100.2	405.6	976.8	11.276	0.055400

T_2, °F		v_2, cu. ft./lb.				Compression Exponent				ΔH, Btu./lb.			
Actual	Prop.	Actual	Prop.	Prop.-Act. T_2	Ideal	Actual	Prop.	Prop.-Act. T_2	Ideal	Actual	Prop.	Prop.-Act. T_2	Ideal
260	265	1.449	1.472	1.467	1.574	1.272	1.290	1.287	1.299	77.6	77.8	77.7	83.0
250	268	1.745	1.798	1.741	1.910	1.280	1.304	1.275	1.318	116.1	117.5	115.6	124.4
220	222	1.514	1.525	1.520	1.652	1.268	1.278	1.270	1.299	57.3	57.6	57.4	62.1
360	334	0.201	0.1746	0.2026	0.284	0.910	0.840	0.919	1.071	30.8	28.4	30.5	38.0
280	265	0.348	0.325	0.347	0.455	0.923	0.875	0.933	1.075	17.9	17.4	18.14	21.9
400	389	0.231	0.226	0.232	0.305	0.895	0.858	0.894	1.064	12.0	12.7	12.94	15.9
243	247	0.080	0.0779	0.0768	0.1028	1.247	1.230	1.193	1.293	30.2	29.2	29.0	37.5
157	153	0.080	0.0763	0.0780	0.1165	1.255	1.190	1.244	1.287	10.8	10.2	10.35	15.33
184	188	0.320	0.319	0.311	0.347	1.270	1.282	1.347	1.299	27.7	27.6	28.2	29.85
150	155	0.1805	0.1877	0.1836	0.274	1.054	1.156	1.114	1.188	17.7	18.4	18.15	25.6
70	60	0.3484	0.332	0.343	0.478	1.107	1.057	1.100	1.221	21.6	21.9	22.3	28.9
40	37	0.5743	0.569	0.575	0.709	1.133	1.117	1.132	1.236	26.0	26.85	27.0	32.0
190	231	0.0276	0.0285	0.0281	0.00719	7.72	10.74	9.40	1.228	135.7	137.5	136.3	50.5
153	219	0.0321	0.0342	0.0323	0.0177	8.61	16.40	9.19	1.236	65.2	67.0	64.7	51.7
182	195	0.060	0.0640	0.0618	0.0988	1.820	1.957	1.856	1.247	26.5	28.4	27.8	51.7
279	279	0.2343	0.239	0.239	0.2000	1.602	1.600	1.600	1.405	187	191.5	191.5	167.5
344	360	0.1043	0.1107	0.1092	0.0710	1.854	1.947	1.910	1.407	283.5	300	297.5	216.5
162	170	0.0891	0.0938	0.0931	0.0545	2.235	2.58	2.48	1.407	88	93.3	93.2	58.0
176	175	0.509	0.509	0.511	0.531	1.316	1.300	1.310	1.304	48	48.2	48.4	50.3
240	238	0.3004	0.301	0.303	0.311	1.343	1.336	1.347	1.304	80	80.2	80.4	83.7
256	261	0.467	0.471	0.468	0.482	1.312	1.315	1.307	1.310	101.9	103	102.6	105.5
168	151	0.389	0.3584	0.377	0.495	1.006	0.950	0.994	1.127	23.8	22.5	23.15	28.4
103	92	0.702	0.672	0.696	0.838	1.035	1.006	1.045	1.139	20.0	19.6	19.84	23.0
143	130	0.346	0.334	0.348	0.479	0.951	0.911	0.966	1.124	12.8	12.0	12.4	16.1
900	910	0.2466	0.248	0.242	0.302	1.273	1.270	1.238	1.307	131.9	133.0	131.3	160.0
600	606	1.6291	1.643	1.630	1.740	1.297	1.310	1.293	1.313	71.9	72.5	72.2	76.6
800	813	0.4034	0.410	0.402	0.474	1.277	1.294	1.268	1.310	129.5	131.1	129.7	150.5

Number of Cycles Checked—Table III

% ΔH Error	Proposed Method +Error	Proposed Method −Error	Prop. Meth. Using Actual T_2 +Error	Prop. Meth. Using Actual T_2 −Error	Ideal Gas +Error	Ideal Gas −Error
0–1	6	1	8	5	–	–
1–2	5	–	2	–	–	–
2–3	2	2	2	1	–	–
3–4	2	1	2	2	1	–
4–5	–	–	2	1	2	–
5–6	2	3	1	–	–	–
6–7	1	1	–	–	2	–
7–8	1	–	1	–	1	–
8–9	–	–	–	–	2	–
9–10	–	–	–	–	–	–
10–15	–	–	–	–	1	1
15–20	–	–	–	–	2	–
20–25	–	–	–	–	5	2
25–30	–	–	–	–	1	–
30–40	–	–	–	–	2	1
40–50	–	–	–	–	2	–
50–60	–	–	–	–	–	–
60–70	–	–	–	–	–	1
70–80	–	–	–	–	–	–
80–90	–	–	–	–	–	–
90–100	–	–	–	–	1	–

and Eq. 17 to obtain capacity in pounds per minute.

5. Find the compression exponent, k', using Eq. 11.

6. Determine power required from Eq. 18.

Although the steps in the proposed calculation method have been presented in the sequence for determination of quantity handled by and power required for a given compressor, they can be rearranged to find the compressor piston displacement and clearance necessary to handle a given quantity or to produce a given load.

Evaluating the Method

To investigate the reliability of the proposed method twenty-seven compression cycles, involving nine different gases, were calculated and results compared to those obtained from thermodynamic data.

Another series of calculations, based on the proposed method but using values of T_2 obtained from thermodynamic data rather than calculated values, was made to determine the influence of temperature discrepancies. Cycles based on ideal gas laws were also computed to point out errors involved in neglecting deviation effects. Results are summarized in Table II.

Actually, for a given compressor operating at specified terminal pressures, the quantity handled and power required are dictated by specific volume at inlet conditions and the exponent of compression and reexpansion paths. To make the comparison more complete, however, various other values have been involved in Table II. Of particular significance is ΔH per pound, which includes the effects of both v_1 and k'.

Change in enthalpy per pound, ΔH, was found by substituting inlet specific volume, v_1, for V_1 in Eqs. 2 or 18 and solving for horsepower per pound per minute and then calculating the Btu. equivalent by means of the following relationship:

$$\text{Btu./lb.} = (\text{hp./lb./min.})(33{,}000/778) \quad (19)$$

Using ΔH per pound as found from the thermodynamic literature as a standard of comparison, the error of the proposed method and ideal cycles was calculated. A tabulated analysis of ΔH error for the various calculation methods used is shown below in Table III:

Maximum errors encountered for the various calculation methods were:

Method	Maximum ΔH Error, % +	−
Proposed	7.17	6.67
Proposed using actual T_2	7.83	4.17
Ideal gas	95.0	62.8

Since the use of the actual discharge temperature, T_2, in the proposed method produced results only slightly better than those using T_2 as calculated, the use of involved methods for approximating this temperature are scarcely justified.

Use of ideal gas relationships introduced errors in excess of 20% for fifteen of the twenty-seven cycles considered. Fig. 4, which is based on the compression of ethylene, shows the various cycles included in the calculation comparisons.

Sample Calculation

We want to compress a 24-76% volume mixture of N_2-H_2 from 4,000 psia. and 100 F. to 15,000 psia. What is the basic power requirement for a 15% clearance and 20 cfm. piston displacement?

Applying the principle of Eq. 15, $p_c = 350.5$ psia, $T_c = 109.5$ R and $M = 8.26$. M_{cp} calculates out to 6.91.

From Eq. 9, the gas constant R equals 187, and the reduced pressure and temperature at the inlet are 11.42 and 5.11. From Fig. 6, Z_1 equals 1.20.

Equation 10 permits calculation of v_1, which is equal to 0.2182 cu.ft./lb. Then Eq. 13 yields a k value of 1.407.

Now T_2 from Eq. 12 equals 820 R., and the reduced pressure and temperature at discharge are 42.8 and 7.49. From Fig. 7, $Z_2 = 1.56$.

Equation 10 gives a value of 0.1107 cu.ft./lb. for v_2, and the compression exponent k' calculates out to 1.947 (Eq. 11).

Then Ev_1 equals 0.854, and V_1 equals 17.08 cfm.

Basic hp. is obtained from Eq. 18, and equals 552.

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Chemical Engineering Fundamentals

What Commercial Reactors Look Like

This series has helped in the kinetic analysis and design of reactors. Now, here's how they'll look in finished form.

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WITH this installment we bring to a close a 15-part series on the subject of reactor design (*Chem. Eng.*, CE Refresher, Aug. 1955 through Oct. 1956). We have discussed: Why Kinetics for Reactor Design?; Reactor Design for Complex Reactions; Reactor Design for Catalytic Reactions; and Catalytic Reactor Design Problems.

It has been our intention to pause somewhere along the line and take a look at the finished product of our kinetic analysis and design calculations: the commercial reactor. Now is the time. And probably this is the appropriate way to conclude a series on reactor design.

How to Classify Chemical Reactors

In an earlier installment we suggested a way to classify chemical reactors (*Chem. Eng.*, Sept. 1955, p. 204). We proposed four major categories:

1. Simple batch homogeneous reactors.
2. Semibatch reactors.
3. Continuous homogeneous reactors.
4. Continuous heterogeneous reactors.

On the following pages we show some examples of these reactors as they are used commercially. For each reactor we list where it's used, advantages, disadvantages and the kinetic equation that applies.

Note that in some cases the actual physical piece of equipment may resemble or be the same as that used in another category. The difference in classification may be due to a change in the method of operating the equipment. This is the case, for example, with batch, semibatch and stirred continuous reactors.

Simple Batch Homogeneous Reactors

In the true batch reactor (Fig. 1) all of the reactants are charged at the beginning of the run. The reaction takes place in a closed system. That is, no material is added or removed during the reaction period. At the end of the run the reacting mass is discharged at one time.

The advantage of a batch stirred-tank reactor is that it is a relatively simple one which can be used for a fairly complicated process. It is more versatile than a continuous reactor.

However, there are some disadvantages associated with this reactor. It requires more operating labor than a continuous reactor and it involves a complicated operating cycle.

The batch stirred-tank reactor is used on small-scale processes, on complicated processes, or on new processes that have not been fully developed for continuous operation.

Semibatch Reactors

In Fig. 2 we show a tank with outside circulation and with injection of one reactant through the pump. This is an example of a semibatch reactor.

There are some reactions which may be carried out in a reactor that is neither a true batch nor a true continuous type. In a reaction such as

$$A + B \rightarrow R$$

the reactor may be charged with A and then B is added continually until the reaction is complete. Two common examples of this procedure are:

- Reaction of a gas with a liquid where the gas bubbles through the liquid.
- Reaction of a highly reactive substance with a relatively inert substance where the reactive substance, if present in large amounts at the beginning of the reaction, would either polymerize or decompose.

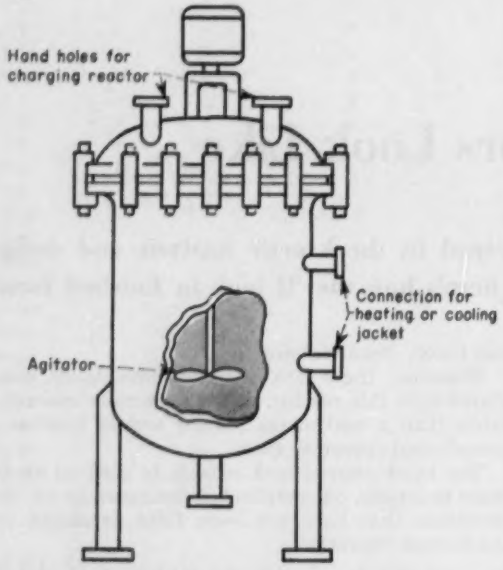
A specific case of the second type of reaction is the addition of ethylene oxide with ethylene glycol to form polyglycols.

Continuous Homogeneous Reactors

We have shown three variations of the continuous homogeneous reactor in Figs. 3a, 3b and 3c. The extreme case of 100% backmixing is found in a stirred-tank reactor. If several tanks are used in series, the net effect is partial backmixing (see Fig. 3a).

In the true longitudinal reactor, Fig. 3b, the reacting mass passes through with no backmixing. Reactors in which backmixing has a considerable effect are the baffled tank (Fig. 3c), packed tower and empty tower. The biggest advantage of this type of reactor is its low cost per unit volume. It is used where these factors apply:

1



Simple Batch Homogeneous Reactor

Where It's Used

In small-scale or complicated processes that manufacture expensive products.

Advantages

General versatility combined with a high yield of the desired product.

Disadvantages

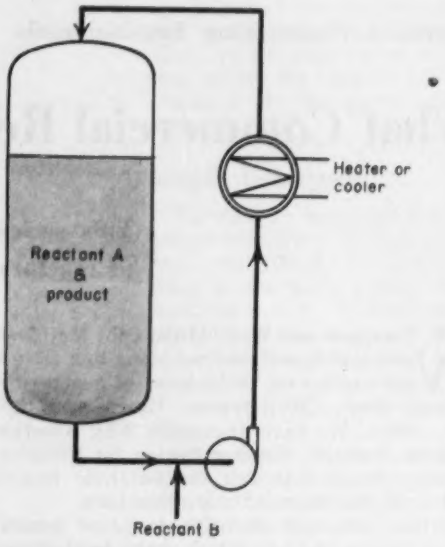
Small-scale production. High labor cost.

Kinetic Equation

For the reaction $A + B \rightarrow R$,

$$\frac{1}{1-M} \ln\left(\frac{M(1-x)}{M-x}\right) = C_{A_0} kt$$

2



Semibatch Reactor

Where It's Used

For carrying out homogeneous flow reactions with addition of one reactant.

Advantages

The concentration of one reactant is kept low. Good temperature control.

Disadvantages

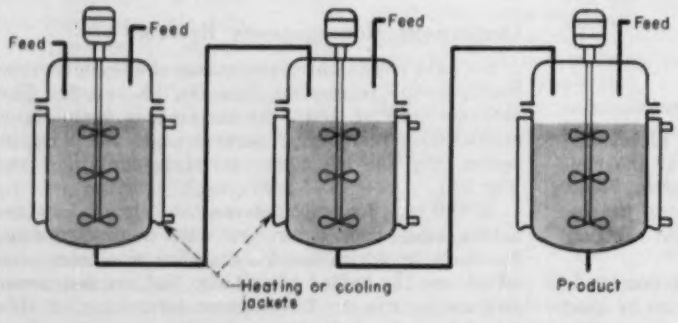
Small-scale production. High labor cost.

Kinetic Equation

$$kC_B' t = \ln[1/(1-x)]$$

where C_B' is a constant dependent on the rate of adding reactant B.

3 a



Battery of Stirred Tanks

Where It's Used

Where agitation is required and where a single tank would be excessively large to obtain the required degree of conversion.

Advantages

See usage above.

Disadvantages

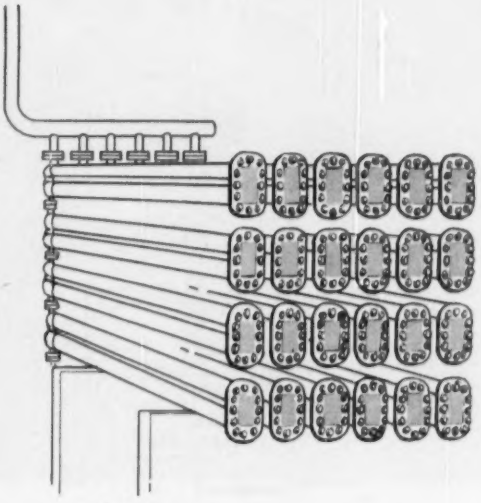
Backmixing in system. More expensive than a single tank.

Kinetic Equation

For first stage,

$$\frac{x}{(1-x)(M-x)} = C_{A_0} kt$$

3 b



Longitudinal Tubular Reactor

Where It's Used

For homogeneous reaction systems.

Advantages

High throughout with little or no backmixing in the system.

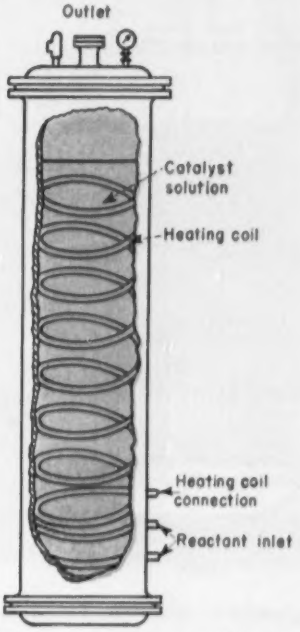
Disadvantages

Holding time fixed for a given throughput. Very expensive for reactions that require high holding time.

Kinetic Equation

$$\frac{1}{1-M}\ln\left(\frac{M(1-x)}{M-x}\right) = C_{A_o}kt$$

1 a



Heterogeneous Continuous Reactor

Where It's Used

For reactions of gaseous products using a liquid catalyst.

Advantages

Close temperature control.

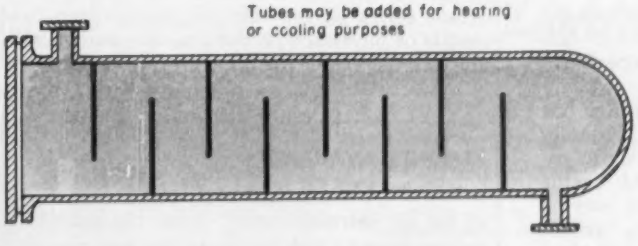
Disadvantages

Low capacity. Not of general applicability.

Kinetic Equation

$$\frac{1}{1-M}\ln\left(\frac{M(1-x)}{M-x}\right) = C_{A_o}kt$$

3 c



Baffled Tank Reactor

Where It's Used

For homogeneous reaction systems.

Advantages

Lower cost per unit volume than longitudinal reactor. Less backmixing than unbaffled tank.

Disadvantages

Considerable backmixing.

Kinetic Equation

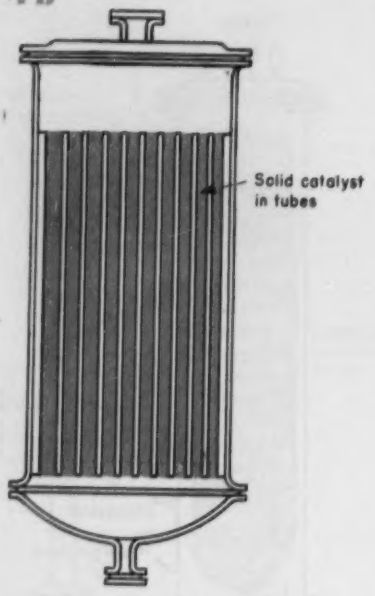
Somewhere between

$$\frac{1}{1-M}\ln\left(\frac{M(1-x)}{M-x}\right) = C_{A_o}kt$$

and

$$x/[(1-x)(M-x)] = C_{A_o}kt$$

4b



Longitudinal Catalytic Fixed Bed

Where It's Used

For vapor-phase reactions with solid catalyst particles.

Advantages

Little backmixing.

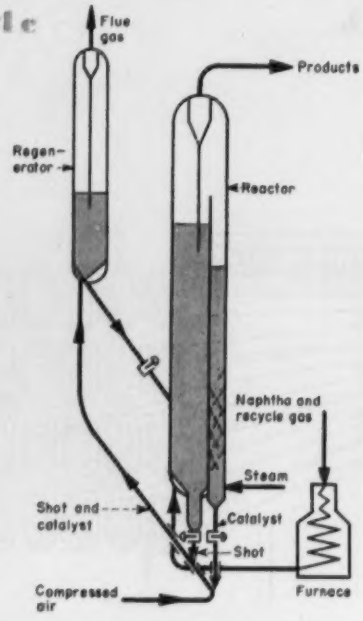
Disadvantages

Possibility of hot spots within bed. Difficult to replace catalyst.

Kinetic Equation

$$\frac{1}{1-M}\ln\left(\frac{M(1-x)}{M-x}\right) = C_{A_0}kt$$

4c



Fluidized-Bed Catalytic Reactor

Where It's Used

For vapor-phase reactions requiring a solid catalyst.

Advantages

Easy catalyst replacement or regeneration. Even temperature distribution in the catalyst bed.

Disadvantages

Backmixing. High equipment cost.

Kinetic Equation

$$\frac{x}{(1-x)(M-x)} = C_{A_0}kt$$

• Long holding time would require a tubular reactor that is too long or too expensive.

• No agitation needed. High degree of backmixing is not harmful to the yield.

Other Continuous Reactors

In Fig. 4a we show a continuous reactor used for bubbling gaseous reactants through a liquid catalyst. This reactor allows for close temperature control.

The familiar catalytic fixed-bed and fluidized-bed reactors are shown in Figs. 4b and 4c. These reactors find most use in vapor-phase catalytic reactions over a solid catalyst. The fixed-bed reactor offers less chance for backmixing but there may be channeling through the catalyst bed causing ineffective use of the entire catalyst charge. Fluidized-bed reactors maintain even temperature control but call for high investment costs.

For descriptions of some moving-bed reactors we refer you to a report by R. E. Vener (*Chem. Eng.*, July 1955, p. 175).

Physical Equilibrium Starts Next Month

Next month CE Refresher will begin an important series on the chemical engineering fundamentals of physical equilibrium. Our author will be James O. Osburn of the State University of Iowa.

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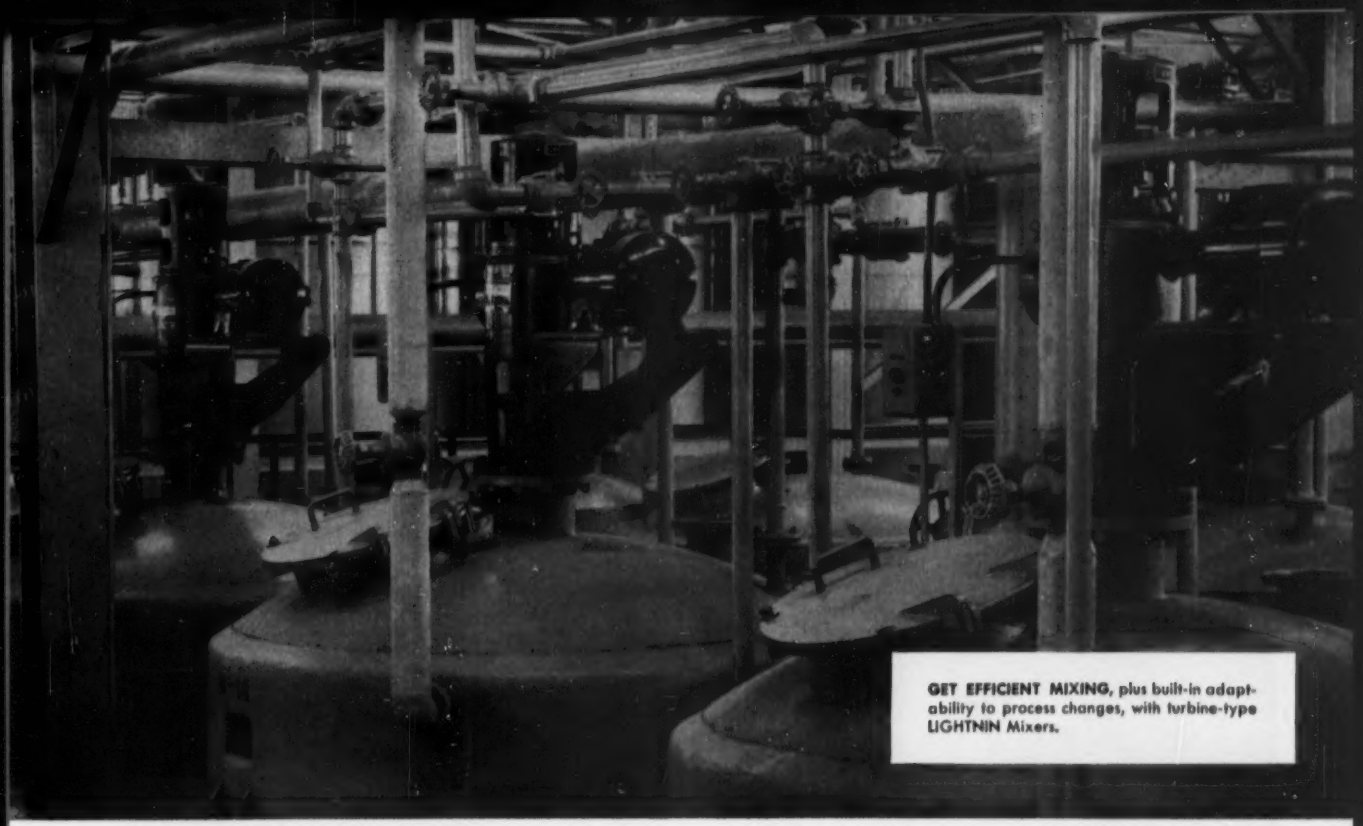
You can now get reprints of the first nine sections of the CE Refresher series. Price 50¢ each. Use Reader Service Cards for fastest delivery. See list of titles available on page facing cards.



GET EFFICIENT MIXING, plus built-in adaptability to process changes, with turbine-type LIGHTNIN Mixers.

Use this **proved method** *to get good fluid mixing*

You can't afford to *guess* about fluid mixing. And you don't need to.

On any mixing operation you can get factual answers to questions like these, to guide you in your mixer selection:

1. What precise balance of *fluid flow* and *fluid shear* will do my mixing job best?

2. If this balance can be attained in different ways, what is the *most efficient* and economical way?

3. In scaling-up, does power required per unit volume remain constant? If not, by what factor does it increase or decrease?

4. Will the mixer transmit the required power to the mix, and do it efficiently?

5. Can the mixer be installed without special construction? Can I get standard replacement parts quickly if I ever need them?

6. Am I protected against mixer obsolescence in case of a process change?

You *know* the answers to these vital questions, when you mix with LIGHTNIN Mixers.

Predicting results

Even on the simplest mixer application, your LIGHTNIN sales engineer's recommendation is based on thousands of pilot runs, plus years of in-the-field experience.

On complex mixing jobs, pilot runs at MIXCO quickly find the impeller-to-tank diameter ratio and input power that will produce the optimum fluid regime most economically. Scale-up is *guaranteed accurate.*

Mechanical economy

Your mixer investment goes into equipment that is mechanically up-to-the-minute. Hundreds of *standard* LIGHTNIN power-speed combinations (interchangeable in many models); widest possible choice of in-stock materials and interchangeable components, give you assurance of correct application, smooth running, and flexibility when you need it.

For fluid mixing that does what you want it to do, call in your LIGHTNIN Mixer representative. (He's listed in Chemical Engineering Catalog.) Or write us direct.

Left: **ANY TANK,** regardless of size or shape, can be fitted with a LIGHTNIN Mixer for correct mixing. ***Right:*** Make any open tank an effective mixing unit, with a LIGHTNIN Portable Mixer. Thirty models.

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MIXCO fluid mixing specialists

FOR LATEST MIXING INFORMATION and full description of LIGHTNIN Mixers, send for these helpful bulletins:

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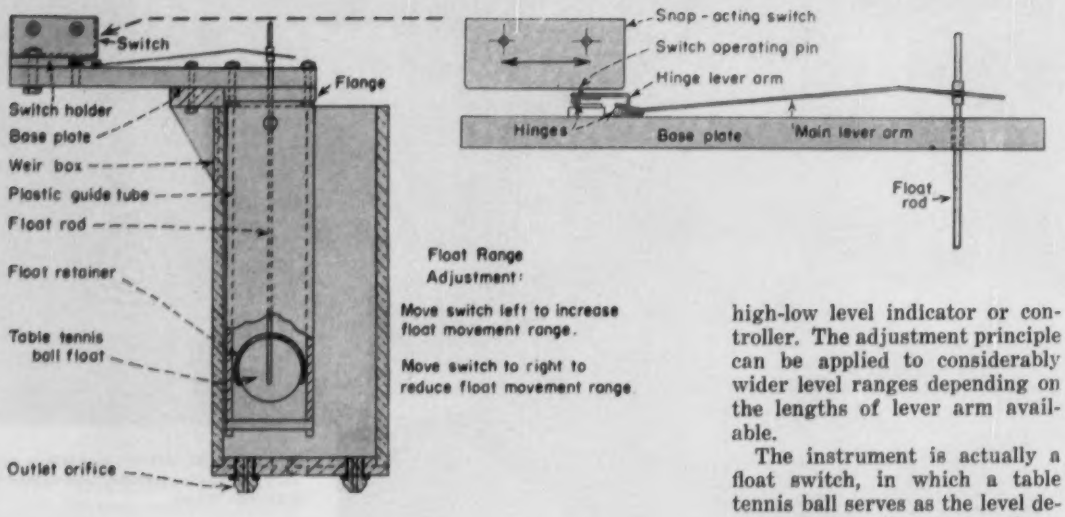
- ☐ B-112 Laboratory and small-batch production types
- ☐ B-109 Condensed catalog showing all types
- ☐ B-111 Quick-change rotary mechanical seals for pressure and vacuum mixing
- ☐ B-107 Data sheet for figuring mixer requirements

Check, clip, and mail with your name, title, company address to:

MIXING EQUIPMENT Co., Inc., 128-k, Mt. Read Blvd., Rochester 11, N. Y.

In Canada: Greey Mixing Equipment, Ltd., Toronto 10, Ont.



★ **Winner of July Contest**

Flow Alarm Is Sensitive, Adjustable

Heart of this device is an ingenious adjustment enabling high-low operating level range to be varied by 8 to 1.

J. R. Wilson

National Chemical Research Lab., South African Council for Scientific and Industrial Research, Pretoria, South Africa.

We recently required a compact instrument which would actuate an alarm and cut off the flow of electric current through a switch when the liquid flow in a particular system fell below a certain minimum percentage of the full flow rate. The instrument should be one having a wide operating range, it should be readily adjustable to any flow condition within its range, and it should be able to withstand the rather corrosive conditions present.

We ruled out commercially available instruments because of high cost and because a large number would be required, but for a relatively short time only.

The instrument which resulted, shown above, can be used as either a maximum or minimum flow alarm by having it measure the head in the outer vessel when the liquid is flowing from the bottom through one or more calibrated orifices. By using a single-pole, double-throw switch, it can signal both high and low flow rates. Or by installing the instrument within a tank requiring level control, it can be operated as a high, low, or high-low level indicator or controller. The adjustment principle can be applied to considerably wider level ranges depending on the lengths of lever arm available.

The instrument is actually a float switch, in which a table tennis ball serves as the level detector and as the source of energy for operating a sensitive snap-acting electric switch. For example, we used a BZ-R5 Micro-Switch. The table tennis ball gives an upthrust of 89 grams in water and is arranged to operate the switch through a double-hinge lever system. The switch is fitted into a slotted holder which enables its horizontal position to be altered on the pivot hinge, thus providing part of the adjustment.

Vertical adjustment is obtained by the use of shim stock under the switch and pivot hinge supports. These two adjustments permit the operating length of

---

★ **Winner of August Contest—Vance O. Bonnichsen**

"Liquid Piston Defeats Pump Corrosion"

How Readers Can Win . . .

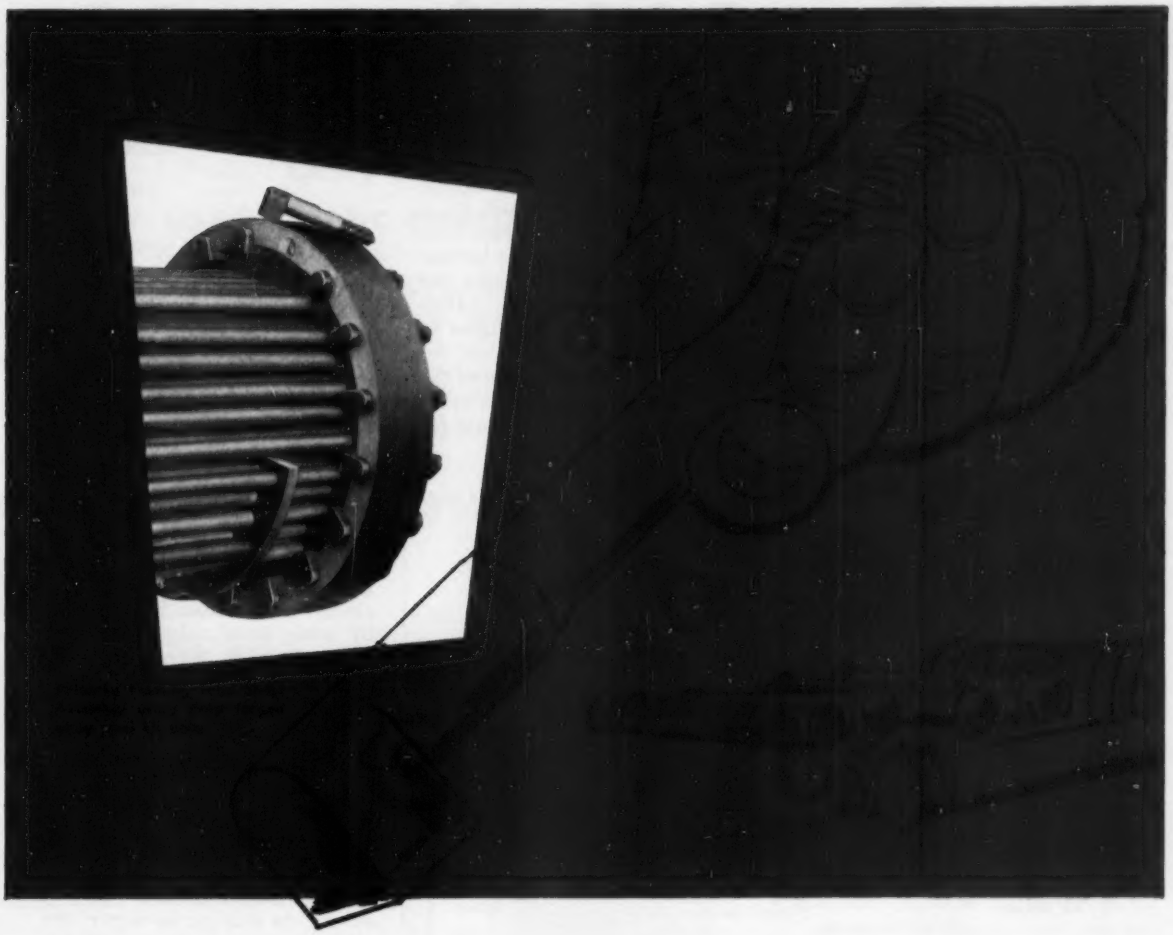
$50 Prize for a Good Idea—Until further notice the Editors of *Chemical Engineering*, will award $50 cash each month to the author of the best short article received that month and accepted for the Plant Notebook.

Each month's winner will be announced in the issue of the second following month, and published the third following month.

$100 Annual Prize—At the end of each year the monthly winners will be rejudged and the year's best winner awarded an additional $100 prize.

How to Enter Contest—Any reader (except McGraw-Hill employees) may submit as many contest entries as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Acceptable non-winning articles will be published at space rates ($10 min.).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, of interest to chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.



This Ell Bolt is the Key to leak control

The patented Ell Bolt construction employed on Vogt floating head heat exchangers is the answer to re-assembly without distortion or leak development.

Cover may be removed by simply loosening the Ell Bolt nuts and disengaging the Ell Bolt heads from the "lock notches." No misplacing of Ell Bolts can result — and tightening is easy and positive — absolutely leak proof. Send for Bulletin HE-6. Address Dept. 24-XC

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HEAT TRANSFER EQUIPMENT

travel of the float to be varied from ½ to 4 in.

The float ball is held in a light retainer secured to the lower end of a ⅛ in. stainless steel rod. This rod passes through a ⅛ × ⅛ in. slotted hole in the end of the main lever arm where it is positioned by two tightly fitted neoprene sleeves. The lever arm itself is a ⅛ × ⅛ in. stainless steel strip soldered at one end to one leaf of a hinge. The detailed drawing shows clearly how the use of two hinges produces a compound lever arrangement giving an adjustable but very small movement at the operating pin of the switch, for a much larger movement of the float.

The float operates in a transparent methyl methacrylate guide tube which is cemented to a flange bolted to the switch base plate. A dowel rod in the bottom of the guide tube prevents the float from dropping out. Interchangeable calibrated orifices in the bottom of the flow box determine the discharge rate of the box and the level at which the switch must be set to operate for any given flow rate.

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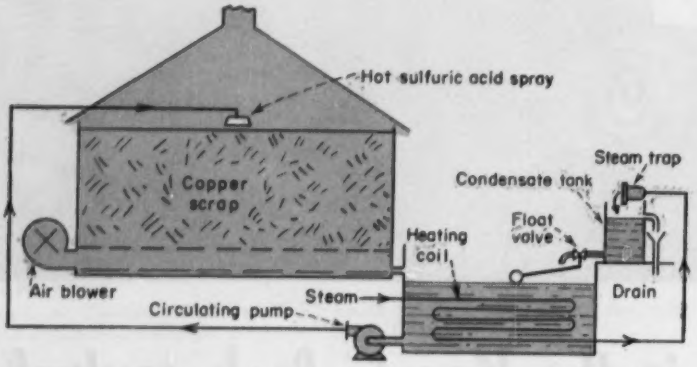


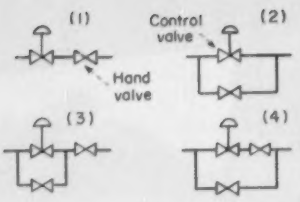
Use Steam Condensate as Water Makeup

Robert W. Moore
Metallurgist, Attleboro Refining Co., Attleboro, Mass.

We operate a copper scrap dissolver in which copper scrap is converted to copper sulfate by alternate cycles of hot, dilute sulfuric acid sprayed over the metal, followed by air blown up through the mass. Considerable evaporation occurs in this process, which necessitates the constant addition of makeup water.

Originally this water addition was accomplished by a simple ball float valve attached to a water line at city water pressure. Lowering of the level in the reservoir tank thus added water as needed. However, the float valve was subjected to the hot, acidic steam vapors from the solution and occasionally the lubrication of the working parts would fail. This, combined with the relatively high pressure of the water, would cause the valve to stick, with resultant flooding or lack of makeup water.

We eliminated this trouble, at the same time conserving heat and water, by changing to the arrangement shown in the sketch. The condensate from the heating coil is caught in a small tank with an overflow to drain. The tank is connected to the float valve so that hot condensate under low static head is returned to the reservoir. With this arrangement the lubrication of the makeup valve is less critical and the unit has now operated for more than two years without attention or failure.



Hand Valves to Decrease Control Valve Range

Tom Ciarlariello
Chemical Engineer, Mine Safety Appliances Co., Pittsburgh, Pa.

In the May 1956 Plant Notebook J. T. Selldorff described how to modify a control valve to give a narrow flow range. A similar result can be achieved by using hand valves in series or parallel with the control valve, or series-parallel combinations as in the sketches above.

The valve or valves can be set to throttle or bypass the control valve to give the desired narrow flow range. Any time a different flow range is needed, the hand valves can be readily readjusted. This easy adjustment is useful in cases where the flow range is subject to change, or where the exact flow range is not known before startup.

Sketches (1) and (2) show arrangements with one hand valve. Sketch (1) has the advantage of making possible tight shutoff if only the control valve is closed (assuming the control valve type permits tight shutoff). With sketch (2) the hand valve also must be closed.

Sketches (3) and (4) are hookups having two hand valves. They give more flexibility and allow a wider choice of control valves. In all the arrangements the control valve is unchanged regardless of the adjustment, and so may be interchanged with another standard control valve.

In the series arrangements the flow range is decreased by allowing a large pressure drop across the control valve when it is nearly closed, and a low pressure drop when it is nearly open. In the parallel arrangements the flow range decrease is obtained by using the control valve on only a small percentage of the total flow.

How it Works!

Only new Sarco TD steam trap uses kinetic energy of steam to close valve

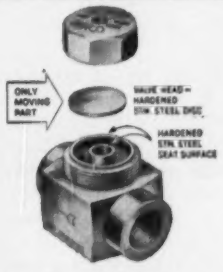
GAS MANTLES have been replaced by electric lights, steam locomotives by diesels, propeller planes by jets.

Now, the use of the kinetic energy of steam principle gives us a modern type steam trap.

The Sarco TD obsoletes all other types for 10 to 600 psi installations. For example, it operates without a valve closing device—no bucket, float, bellows, pins, levers or gaskets.

Glance below and you'll agree that no other steam trap is even similar to the Sarco TD!

For a trial installation—write today.



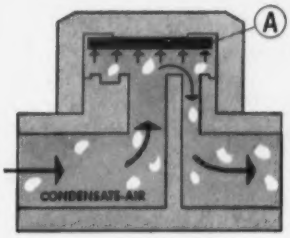
Only 3 parts... all stainless steel

Sizes ⅜ to 1"—each body is as small as a tee fitting! Capacity is determined not by a bulky body but by the effective orifice, valve action, pressure drop and condensate temperature.

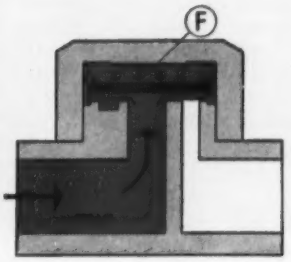
Many Advantages

1. *Practically no maintenance*—no valve mechanism, no narrow channels. Trouble-free simple design. Only 3 parts—all stainless steel.
2. *One trap for all pressures*—self-adjusting. One large capacity seat for 600 psi as for 10 psi. No changes or adjustments.
3. *Operates equally well on all loads*—on heavy, light or no condensate load. No prime to lose. No adjustments.
4. *No steam leak required*—to operate the Sarco TD. Closes tight against steam.
5. *Discharges at steam temperature and vents air* and air-steam mixtures at start-up and during operation.
6. *Freeze-proof*—when installed with outlet down, free to drain.

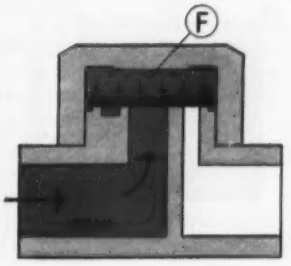
Only Sarco TD Thermodynamic Steam Trap Uses This Unique Operating Principle Which Permits Trouble-Free TD Design



1. Inlet pressure raises disc "A" from seat... immediate discharge of air and condensate at steam temperature.



2. Steam follows the condensate and the high velocity jet across the bottom of disc "A" creates a low pressure area (Bernoulli effect)... the jet is deflected into chamber "F" where it builds up pressure by recompression and this pressure acts on the top of the disc "A"...



3. Pressure in chamber "F", acting on full top area of disc "A", exceeds force of incoming steam and low pressure area under the disc... and immediately forces it down, closing the inlet. As condensation decreases the pressure in chamber "F", the disc rises and steps 1 or 2 repeat.

60-day trial convinces... No obligation... Use coupon!

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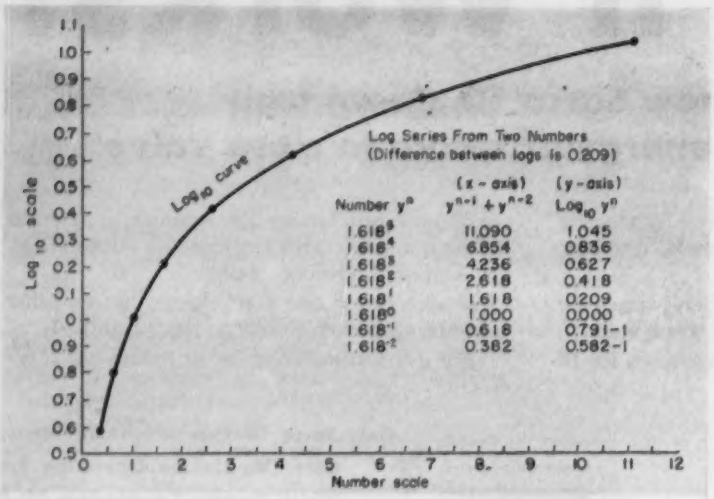


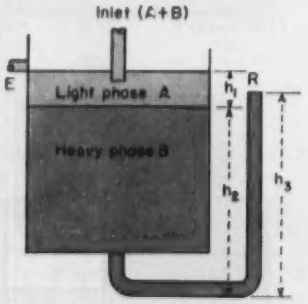
Two Numbers That Make a Log Plot

J. H. Smith
Santa Barbara, Calif.

In the June 1956 Plant Notebook (p. 262), C. Volff gave a simple "memory" series of 10 numbers which was close enough to a Base-10 log series to permit approximate calculations. He also referred to the Gold Number series of the ancient Greeks in which each term was 1.618 times the next lower term, and equalled the sum of the next two lower terms. By remembering just *two* numbers it is possible at any time to draw up an accurate Base-10 log plot from which the logs can be read with at least two-place accuracy.

These numbers are 1.618 (the Greeks' Gold Number), and 0.209, which is the difference between the Base-10 logs of succeeding numbers in the Gold Number or Fibonacci series. Where $y = 1.618$, the Fibonacci series is $y^n = y^{n-1} + y^{n-2}$, that is (as the table shows) each number of the series, such as 1.618^5, equals the sum of the next two lower numbers, such as 1.618^4 and 1.618^3. Furthermore, since the log of 1.618 is 0.209, then you immediately have at hand a means of finding the logs of all numbers in the series, such as 1.618 (log = 0.209), 1.618^2 (log = $3 \times 0.209 = 0.627$), etc.

If you wish, of course, you can remember the two numbers to a greater number of digits, i.e., 1.61803 and 0.20899, but you cannot plot to such accuracy, so there is no need to burden your memory with the extra four figures.



"Manometer Decanter" Separates Immiscibles

R. L. Milloch
Chemical Engineer, Research, Chemicals Dept.,
The Quaker Oats Co., Omaha, Neb.

For certain pilot plant operations we needed to separate two immiscible liquids continuously and automatically by decantation without the use of expensive instrumentation. After making the following analysis, we rigged up a simple decanter to operate on the manometer principle.

In a manometer containing two immiscible phases the various heads (see sketch) have the following relations:

$$h_1 d_a + h_2 d_b = h_3 d_b$$

where the h's are the heights shown in the sketch and d_a and d_b are respectively the densities of lighter phase A and heavier phase B. h_1 is an arbitrarily chosen depth, but in relation to the relative densities and the total manometer height, this establishes the height at which heavy-phase discharge R is located.

The larger leg of the manometer (i.e., the tank) must be sized to allow sufficient time for the two phases to separate. When additional phase A is added to the system it will overflow at E. Similarly, additional phase B added to the system will underflow and discharge from point R.

Now Calculate Dewpoint Without Tables

M. W. Africa
Engineer, Technical Section
Koppers Co., Inc., Pittsburgh, Pa.

Having the wet and dry bulb temperatures, and the barometric pressure, how can you find the dewpoint if the barometer is not 29.92 in. Hg? Probably you will refer to Bulletin W. B. No. 235, "Psychrometric Tables," published by the U. S. Department of Commerce, Weather Bureau. If so, you will take the dewpoint from the tables, based on a barometric pressure nearest the one in question—that is, provided you have a copy of the bulletin handy.

Lacking the tables, you can reach for your steam tables and gain the desired result with the analysis presented here. The psychrometric equation below will give an answer which is in substantial agreement with the results you would get from the psychrometric tables.

The equation is based on the theory that the wet bulb temperature represents an equilibrium condition where heat ea-

Powell Lubricated Plug Valves

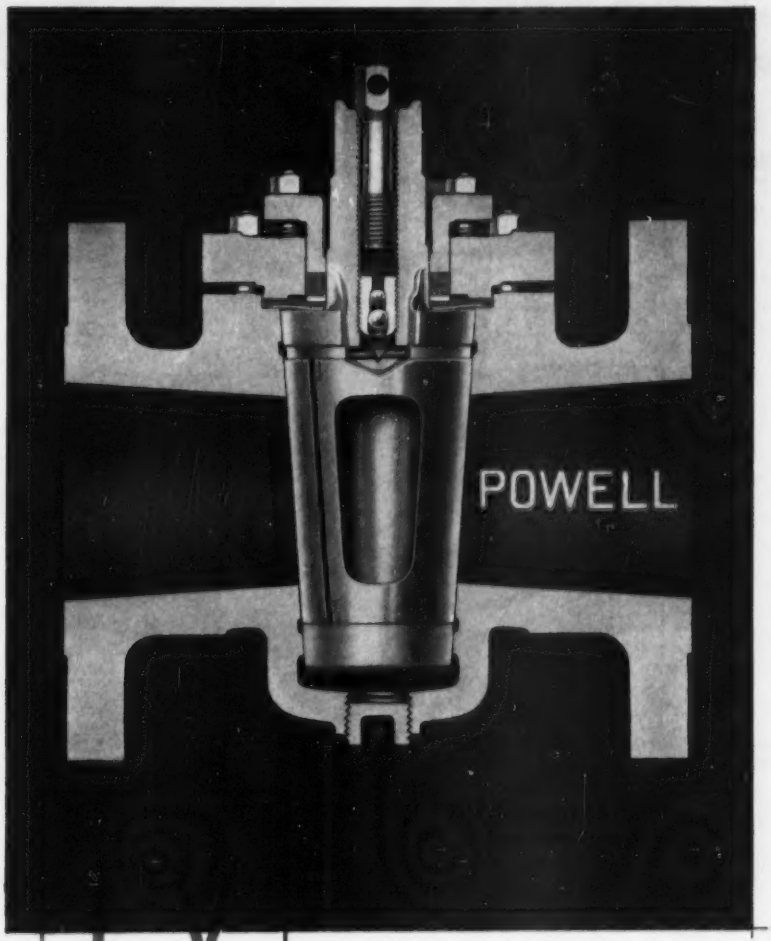


FIG. 1559G—150-pound Steel Lubricated Plug Valve. Gear operated

FIG. 2200—175-pound W.O.G. Semi-Steel Lubricated Plug Valve

VERIFIED

Powell Lubricated Plug Valves maintain the 110-year tradition of quality and precision. Only the finest available materials are used. And painstaking quality control is rigidly enforced through each and every step of manufacture.

Valve users who want one source of supply for lubricated plug as well as all types of bronze, iron, steel and corrosion-resistant valves will want full details on Powell Lubricated Plug Valves.

For example, features include quick and positive operation—just a quarter-turn to open or close. Lubricant grooves surrounding each port provide a positive seal when the valve is closed. In an open position, seating surfaces are not exposed. Available in Steel and Semi-Steel through distributors in principal cities.

For full details, write for the new PV-4 Catalog on Powell Lubricated Plug Valves. Just fill out the coupon and mail. Of course there's no charge, no obligation.

THE WM. POWELL COMPANY
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Cincinnati 22, Ohio

Gentlemen:

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The source of supply for all valve needs!

POWELL VALVES...110th YEAR

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES.

Nomenclature

A	Group $= p_v(P - p_v)$
C_{pa}	Heat capacity of air or gas, Btu./(lb., °F.); 0.241 for air.
C_{pv}	Heat capacity of water vapor = 0.48 Btu./(lb., °F.).
M	Molecular weight of air or gas.
P	Total pressure, or barometric pressure, in. Hg.
p_v	Vapor pressure of water vapor at saturation or dewpoint temperature, in. Hg.
p_w	Vapor pressure of water vapor at t_w, in. Hg.
t_d	Dry bulb temperature, °F.
t_w	Wet bulb temperature, °F.
λ	Latent heat of water at t_w, Btu./lb.

pacity of the air and water vapor, above the wet bulb temperature, is just sufficient to evaporate enough water from the wet bulb to saturate the air in immediate contact with it at a temperature t_w. The heat balance set up in the equation applies to any inert atmosphere (air or gas), and to any total pressure. The term p_w can be found from the steam tables and all other terms in the equation are known, except p_v. Therefore it is an easy matter to find p_v, from which the steam tables will show the dewpoint. Here is the equation:

$$MC_{pa}(t_d - t_w) + 18C_{pv}(t_d - t_w)A = 18\lambda(p_w/(P - p_w) - 18\lambda A$$

where 18 is the molecular weight of water, and $A = p_v/(P - p_v)$. If the gas is air, then the equation simplifies to:

$$(6.977 + 8.64A)(t_d - t_w) = 18\lambda(p_w/(P - p_w) - 18\lambda A$$

Solve for A. Then, since $A = p_v/(P - p_v)$, solve for p_v. Incidently, $p_w/(P - p_w)$ and $p_v/(P - p_v)$ represent the number of moles of water vapor per mole of dry gas or air at t_w and t_v, respectively. Their difference therefore represents the maximum amount of water which can be turned into vapor at equilibrium.

A check on the accuracy of the equation using a barometric pressure of 23 in. Hg, the lowest covered in the tables, together with a dry bulb of 80 F. and a wet bulb of 60 F., gives $p_v = 0.357$ in. Hg, corresponding to $t_v = 49.6$ F. The corresponding dewpoint given in the psychrometric tables is 49.0 F.

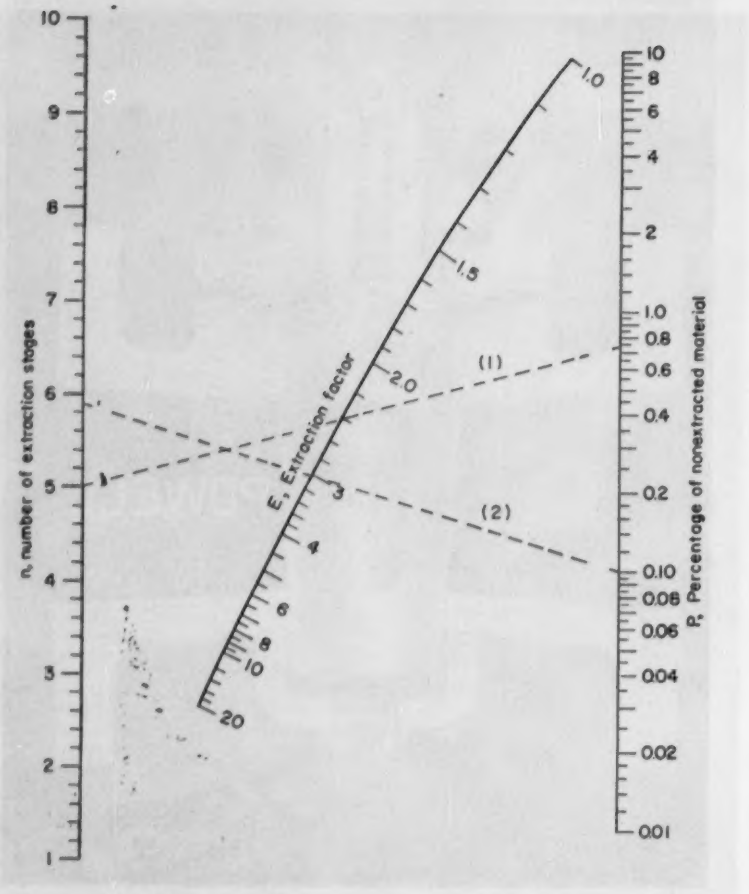

Chart Finds Stages for Extraction

Dale S. Davis

Professor of Engineering, University of Alabama, Tuscaloosa, Ala.

For countercurrent extraction, Alders ("Liquid-Liquid Extraction," p. 95, Elsevier Publ. Co., New York, 1955) gives the formula:

$$P = 100(E - 1)/(E^{n+1} - 1)$$

where P is the percentage of unextracted solute; E is the extraction factor, that is, the ratio of amount of solute in extract phase to that in raffinate phase; and n is the number of extraction stages.

This equation can be solved readily and accurately by means of the accompanying line coordinate chart. Use of the chart is illustrated as follows:

1. What is the percentage of non-extracted solute when the extraction factor is 2.4 and five stages are employed in a countercurrent operation? Connect 5 on the n-scale and 2.4 on the E-scale with straight line (1) and note the intersection with the P-scale at 0.74%.

2. How many countercurrent stages are needed to reduce the percentage of non-extracted solute to 0.1 when the extraction factor is 3.0? Connect 0.1 on the P-scale and 3.0 on the E-scale with straight line (2) and note the intersection with the n-scale at 5.9. Six countercurrent extraction stages would therefore be required.

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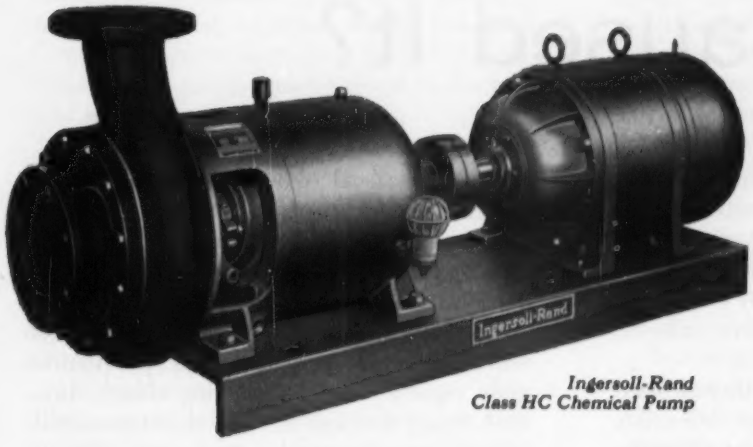

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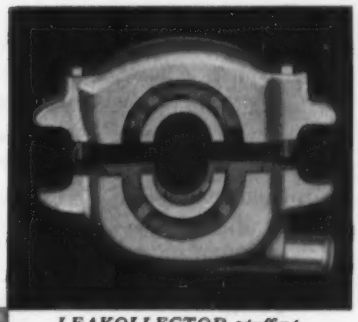

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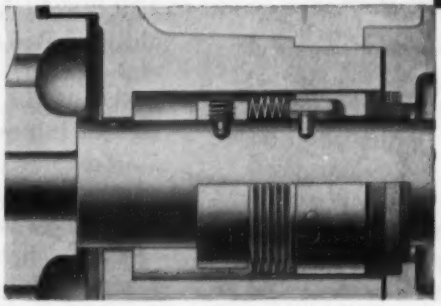

Cross section of Cameron Shaft Seal

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THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

What Caused It?

WHY is the United States confronted with a serious shortage of scientists and engineers?

One reason, discussed in earlier editorials in this series, is that the increasingly complex technology needed for national security and for an expanding economy has raised enormously the demand for technically trained people.

But it is clear also that too little has been done to increase the supply of scientists and engineers and to make most effective use of the limited number now available. It is with this second reason for the shortage that this editorial deals.

Too few bright young people have been attracted to careers in the sciences and engineering. Many with technical training have been leaving these professions, with the exodus from teaching being especially alarming. And the technical talent now employed in industry, government and education is, in too many instances, being utilized less effectively than it might be.

Paying for a Miscalculation

A legacy of the depression provides part of the explanation for the current shortage of young people entering scientific and engineering careers. Because of low birthrates in the 1930s, there are now about one million fewer boys and girls of college age than there were in the early 1940s. Not until 1960 will there be as many in the 18-21 age group as in 1945. And from the brightest young people of these ages must come, not only scientists and engineers, but the new members of all the professions needed by our growing economy.

A miscalculation in the late 1940s, when our future needs in various occupations were being gauged, provides another part of the explanation. Occupational counselors and high school students were advised that, because of heavy postwar enrollments in engineering and other technical fields, "it is likely that the shortages of trained men will be alleviated in a few years."*

Instead of being alleviated, however, the shortages became more acute. Job opportunities grew rapidly, while graduating classes dwindled. Fewer than half as many students received degrees in engineering in 1955 as in 1950, the peak postwar year. The trend has been reversed, but graduating classes will not be large enough to narrow the gap for several years.

Lost Talent

Beyond these temporary conditions, there is another explanation for the failure of the number of scientists and engineers to keep pace with our rising needs. This is the staggering loss between high school and college of young people with the talent to be successful in science and engineering. **Last year between 60,000 and 100,000 high school graduates of college ability failed to enroll in college for financial reasons and perhaps an additional 100,000 did not enter college because of lack of interest.†**

Of the most intelligent 20 percent in the group of college age, fewer than half enter college and only about a third graduate from college. Educational authorities estimate that fewer than 2 percent of those in the college age group who are mentally equipped to obtain Ph. D. degrees will actually obtain such degrees.

Another crucial stage is in the high

*U. S. Bureau of Labor Statistics, *Occupational Outlook Handbook* (Bulletin 940), p. 63.

†Charles C. Cole, Jr. (assistant dean, Columbia College, Columbia University), *Higher Education*, November 1955.

schools, where future scientists and engineers receive their first training in science and mathematics. There are serious weaknesses and signs of deterioration in this vital part of our educational system.

One-quarter of all American high schools offer no chemistry or physics. One-quarter offer no geometry. In many of the schools offering science and mathematics courses, the quality of instruction is low. Last year in the New York City school system alone more than 10,000 students were in science classes taught by teachers who were not trained in science.

This is a situation that threatens to become much worse. Between 1950 and 1955 the number of graduating teachers qualified to teach high school mathematics dropped 53 percent and those qualified to teach science dropped 59 percent. Furthermore, only about 60 percent of the graduates certified to teach mathematics or science in 1955 entered teaching as a career.

On the students' side — partly because of inadequate guidance programs — there has been a drift away from science and mathematics courses. The result of low student interest, and poor high school programs, in science and mathematics is virtually to foreclose careers in science and engineering to many bright young people. They miss the necessary basic training. Many who do attempt to obtain college training in these fields are ill-equipped. Engineering school deans report that fully half of their students enter with deficiencies in mathematics.

Misuse of Trained People

Scientific and engineering careers have long had a reputation for low salaries and limited opportunities for advancement. In recent years starting salaries have sky-rocketed and have been accorded wide publicity. But unfortunately there has been much less improvement in the salaries paid experienced engineers and scientists, especially in government and education. This has lowered the morale of experienced men and provided an incentive to desert engineering and research positions for higher paying jobs in sales or management.

Engineers and research scientists complain also that too much of their time now is spent on tasks that draftsmen and technicians could perform. Unfortunately for easy solution of this problem, however, there is an acute shortage of technicians as well. Worse still, there are indications that some companies in industries using large numbers of engineers have gobbled up technical manpower at a faster rate than they can effectively employ these scarce people.

Another drain on the supply of newly-trained scientists and engineers is military service. About 8,000 of this year's 27,000 engineering graduates were in ROTC programs and committed to active duty after graduation. Dr. A. W. Davison, chairman of the Engineering Manpower Commission of the Engineers Joint Council, says that in most cases no attempt is made by the Armed Services to assign these young officers to duties for which their engineering education specifically prepared them. They are not only withheld from industry and education for two years but also are not utilized in defense programs requiring more engineers and research scientists.

Some of the causes for the present shortage of scientists and engineers — bad advice a few years ago and a college age group held down by depression birthrates in the 1930s — are gradually being overcome. But others, such as the deterioration of science and mathematics training in our public schools and the many instances of ineffective utilization of scarce technical talent, enjoy no such prospect of automatic correction. The final editorial in this series will deal with some practical suggestions for meeting these problems.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

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CE's Helps for License-Minded Chemical Engineers:

August 1955: *Are You Ready for Professional Registration?*

February 1956: *How You Can Pass the Registration Exam*

Now, in October

How You Can Register in Other States

John D. Constance, P.E., Cliffside Park, N. J.

AFTER THE FIRST two articles in this series had appeared, both licensed and unlicensed men wrote me to lament the geographical limitations on the professional engineers' license. This article tells how to remove these limitations and make a professional license more valuable.

Engineers simply cannot accept state or regional boundaries as limits on their activities because of the very nomadic nature of engineering practice itself. The next job, the next project may literally take the engineer anywhere.

However, since each state has the right and duty to regulate engineering within its borders for the protection and welfare of its citizens, it must pass on the qualifications of all engineers who seek to practice there—whether licensed elsewhere or not. The already-licensed engineer is therefore confronted—and often perplexed—by the problem of interstate registration.

You're Okay for Awhile

Fortunately, most states permit engineers duly-licensed in another state to practice for a short time without having to get a new license.

Usually, the engineer can work for 30-60 days in any one calendar year without applying for permanent registration. In some cases, state boards even permit* such temporary practice beyond the legal nominal limit—pending the processing of an application for permanent registration. Check with the state board secretary* for details on this important aspect of interstate registration.

On the one hand the various state registration boards are charged with promoting and facilitating the flow of engineering talent across state lines. On the other, they must prevent the use of interstate registration as a means of getting around the tougher licensing requirements of any other state.

In addition, the varying needs and differing political climates in the various states work against the adopting of a uniform registration law, though this is the ultimate goal.

Must Prove You're Qualified

Licensure by endorsement (without taking any tests) is granted to applicants registered elsewhere by nearly all states. But before a state board will approve an applicant for a license under this provision, it always tries to make certain that he is fully qualified. Applicants may be considered for endorsement if they hold:

- License or certificate to practice professional engineering issued after examination by a legally constituted board in any other state or political subdivision of the United States.
- Certificate of Qualification issued by the National Council of State Boards of Engineering Examiners (NCSBEE).

Provided:

- That when the license or certificate was issued, the issuing state's examination was the full equivalent of the current exam in the state in which the application is being filed.
- That the applicant's record fully met all other requirements—age, citizenship, education, experience and character.

According to NCSBEE, 46 states give maximum possible credit to examinations given by other boards. Two states require an oral examination regardless of written examinations taken in other states and one board recognizes examinations given by only those boards with which it has reciprocal agreements.

Reciprocity Is a Special Case

A special case of registration by endorsement, reciprocal registration involves mutual agreement between two or more states to grant registration by "reciprocity." This procedure presupposes a reasonable equality of qualification requirements. As noted, practically all of the state

JOHN D. CONSTANCE *is a recognized expert in preparing engineers for licensing.*

* *Chem. Eng.*, Aug. 1955, p. 220 lists names and addresses of state board secretaries. Listing for Delaware is in error; write to Mr. Frank T. Lynch, 11 E. 12th St., Wilmington, Del.

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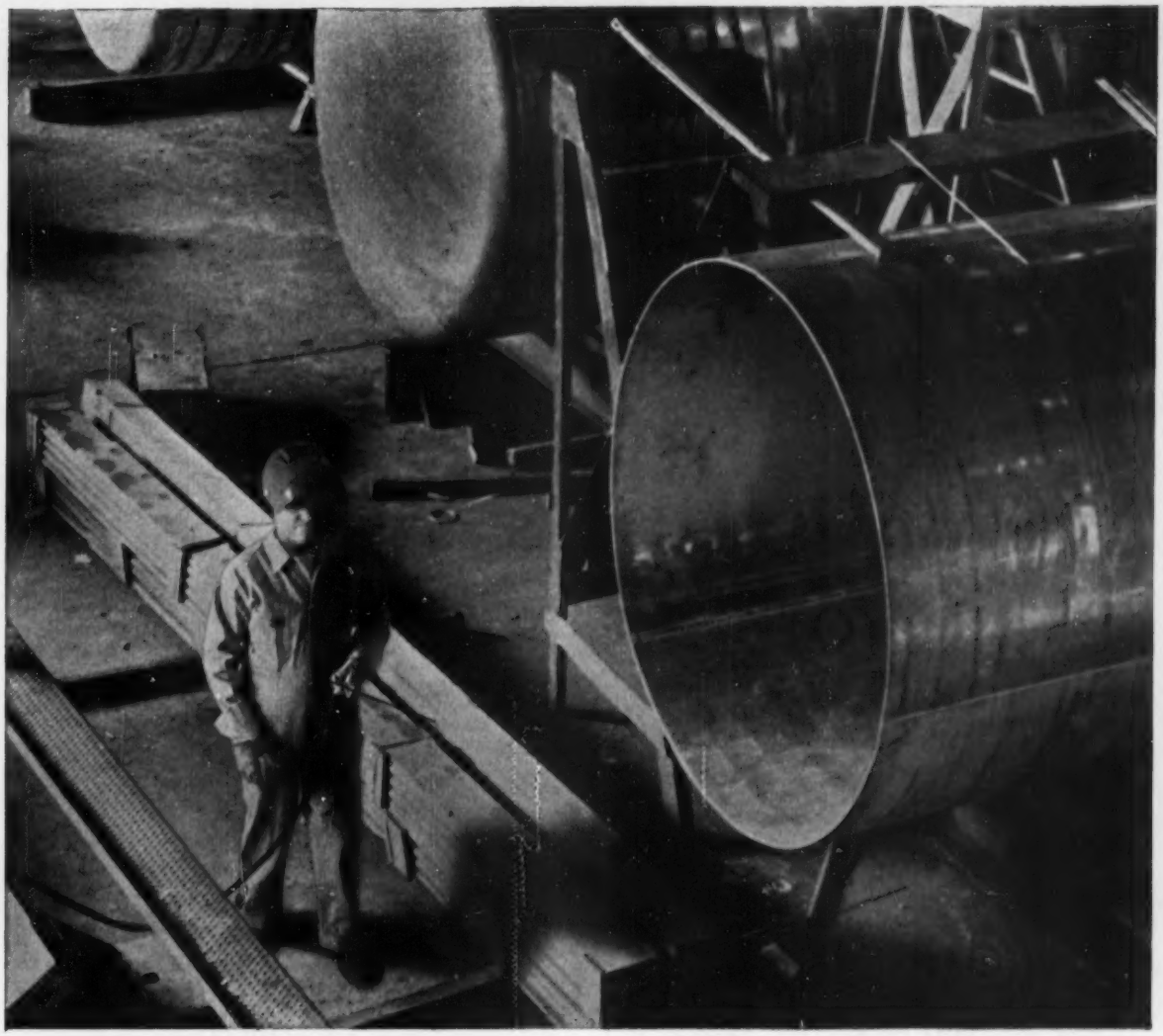

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registration laws permit the waiving of examinations for registration by endorsement. Hence, insisting on reciprocity agreements in addition to such waivers has been found to be fundamentally unsound.

Different states have different standards of qualification, and a state with higher standards balks at lowering them to enter into a reciprocal or blanket agreement. However, all states are attempting to extend such agreements.

NCSBEE's Committee on Registration by Endorsement notes that 50 of the 52 boards will honor a request for a candidate's grades on his written examination in that state when he applies for registration by endorsement in another state. Similarly, 46 of the 52 will honor a request for a copy of the examination taken by the candidate. This shows a definite trend toward reciprocity in practice, if not in law. And it's a happy commentary on the spirit of cooperation that guides members of NCSBEE in their dealings with one another.

NCSBEE Coordinates

Officially, NCSBEE is an advisory and coordinating agency established primarily to help state examining boards in their cooperative effort for more efficient and uniform registration laws. NCSBEE both promotes effective procedure for interstate registration and provides a medium for discussing and developing the solution to this difficult problem.

NCSBEE is supported by each of the various state boards and technical societies. Its executive secretary, T. Keith Legaré can be reached by writing P. O. 1404, Palmetto Life Bldg., Columbia, S. C.

Cuts Time and Cost

To minimize the effort and expense engineers registered in one state must go to to get a license in another, NCSBEE has established the National Bureau of Engineering Registration (NBER). The bureau is a fact finding and qualifying agency which serves as a reliable source of information for state boards and acts as a

What's Needed for Registration by Endorsement

When processing an individual application for registration, each state reserves the right to act as it deems necessary to conform to the requirements of the statutes and regulations in force within its boundaries. But here are the general conditions laid down by each state and territory. For maximum usefulness, we've listed conditions for the general case of registration by endorsement. Reciprocal registration, for those now licensed elsewhere, is a specific example of this general case.

Alabama	Graduation from approved school plus four years of satisfactory engineering experience.
Alaska	Each case considered individually. Qualification requirements of the state of prior registration must not be lower than that of Alaska.
	Proof of residence in Alaska.
	For non-residents, a temporary permit for a period not to exceed one year and limited to a specific engagement may be issued for a fee.
Arizona	Prior registration by written examinations.
	Prior registration based on long practice.
	Prior registration on graduation plus four years of satisfactory engineering experience.
Arkansas	Weight given to prior registration by written exam.
	Meet statutory requirements of training and experience.
	An independent investigation of qualified non-residents.
	No reciprocity agreements with other states.
California	Oral examination in California required.
Colorado	Graduation from an approved school plus three years of satisfactory experience.
	Seven years of satisfactory experience for applicants without educational credit.
	Prior registration under equivalent requirements.
	Except in doubtful cases, no written exam required.
Connecticut	Graduation from an approved school plus four years of satisfactory engineering experience.
	Prior registration by equivalent examination plus eight years of satisfactory engineering experience.
Delaware	Satisfy statutory requirements of education, training and experience.
	Prior registration or National Bureau of Engineering Registration (NBER) certification not recognized.
Florida	Satisfy requirements of training and experience plus prior registration by passing equivalent written examinations in another state.
	Prior registration plus evidence of long established responsible practice (over 15 yr.).
Georgia	Prior registration under equivalent requirements.
	Oral examination in doubtful cases.
Hawaii	Prior registration by passing equivalent written examinations in another state.
	Established standing with more than 12 yr. of practice.
	NBER certification accepted.
Idaho	Prior registration by written examination accepted where a reciprocal agreement exists.
	May deny registration if prior registration was not by written examination.
Illinois	Registration in anther state prior to 1946 based on graduation from an approved school plus four years of experience.
	Graduation from an approved school plus 15 yr. experience plus recognized distinction.
Indiana	Prior registration by written examination.
	Prior registration, on qualification, prior to 1950.
	Prior registration under a "grandfather clause" prior to 1923.
Iowa	Prior registration by written examination.
	Personal interview or other evidence, if prior registration was without written examination.
Kansas	Satisfactory training and experience.
Kentucky	Prior registration on graduation plus four years of experience.
	Prior registration on eight years of experience plus two-day written examination.
Louisiana	Graduation from an approved school.
Maine	Graduation from accredited curricula plus four years of qualifying experience.
	Equivalent written examination in another state accepted in lieu of Maine examination.
	High professional standing plus oral exam in Maine.
	NBEK certification practically always accepted.

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What's Needed for Registration by Endorsement (*continued*)

Maryland	Long practice (over 12 yr.). Graduation from an approved school plus four years of engineering experience.
Massachusetts	Satisfy minimum statutory requirements (Model Law). NBER certification accepted.
Michigan	Twelve years satisfactory experience plus prior registration or NBER certification under requirements equivalent to those of Michigan at that time. Prior registration by written examination under registration requirements equivalent to those of Michigan.
Minnesota	Prior registration under equal statutory requirements in a state extending similar privileges to Minnesota registrants. Graduation from an approved school prior to 1945 plus four years of satisfactory experience. Oral examination waived on NBER certification. Oral examination waived if there is a reciprocal agreement between the two states.
Mississippi	No statement is furnished.
Missouri	Eight years of satisfactory experience, plus passing equivalent oral or written examination elsewhere. Graduation from an approved school plus four years of satisfactory experience. Reciprocal agreements with other states are not required for registration by endorsement, but are required for reciprocal registration.
Montana	NBER certification accepted. Prior registration before 1948 on graduation plus four years of experience. Prior registration on 12 yr. of lawful practice including responsible charge of important work.
Nebraska	Outstanding experience, including five years in responsible charge of engineering work. Prior registration by written examination of reasonably high standards.
Nevada	Oral examination at an official meeting of the Board of Examiners in Nevada.
New Hampshire	Satisfying statutory requirements. Eminent standing in the profession.
New Jersey	Prior registration by passing equivalent written examination in another state. Fifteen years of lawful practice. NBER certification, plus satisfying all other statutory requirements.
New Mexico	Graduation from an accredited school plus four years of satisfactory experience.
New York	Prior registration by passing equivalent written examinations in another state. Prior registration plus evidence of recognized standing and long established practice (over 15 yr.).
North Carolina	Prior registration by written examinations. Prior registration on long practice. Prior registration on graduation plus four year of progressive engineering experience. NBER certification.
North Dakota	Education, 10 yr. experience, eminence plus prior registration by personal interview and oral examination by applicant's home board.
Ohio	Prior registration by written examination. Long practice, if registered elsewhere prior to 1938. Registration prior to 1946 on graduation plus four years of experience. Prior registration before 1935, under "grandfather clause."
Oklahoma	By reciprocity agreements with other states. NBER certification accepted.
Oregon	Prior registration by passing an equivalent written examination in another state. Six years of engineering experience (including two years in responsible charge) prior to enactment of a registration law in the applicant's home state.
Pennsylvania	Only on prior registration by passing a written examination in another state and provided that the other state accepts Pennsylvania examinations.
Puerto Rico	By reciprocal agreement with states. By investigating the original state registration.
Rhode Island	Graduation in an approved engineering curriculum plus four years of satisfactory experience. Twelve years or more of lawful practice of a satisfactory character, provided applicant not less than 35.

clearing house for the records of professional engineers.

Upon application, the bureau studies the applicant's registration with his home state board and reviews his experience record. If approved, the applicant is granted a Certificate of Qualification.

National certification in engineering is still comparatively young. Unlike the medical professional certification, the NBER certificate is not yet accepted by all state boards.

This certificate is not a national license to practice engineering nor does any state board permit its use in lieu of its own state license. It is merely a verified record of the engineer's experience.

But it's also an instrument that makes it easier for a fully competent engineer to cross state lines, and easier for a state board to recognize such competence and avoid duplicating the compiling and rechecking of educational and experience details that have already been reliably compiled and checked.

In its present form the certificate is a photostatic copy of the application bearing the official seal of NCSBEE. It is not suitable for framing.

Some states accept the certificate as meeting all state requirements for engineering registration. Others accept it in part, making use of the verified records of education and experience only. A few feel that use of the certificate would constitute an unlawful delegation of power.

Apply Early, Save Time

When applying for reciprocal registration, the engineer may send an NBER certificate to the board involved, along with the regular state license application form.

All boards want to see up-to-date records. You can supply them either of two ways:

- Bring an original bureau record up to date through the facilities of NBER and submit with the application.
- Complete the state application form and submit for state board checking and approval.

An investigation as conducted by the bureau often takes considerable time. The engineer

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What's Needed for Registration by Endorsement (*continued*)

South Carolina	Prior registration by written examination. Prior registration on long practice. Prior registration on graduation plus four years practice. Prior registration under a "grandfather clause", if applicant's education and experience are acceptable. NBER certification accepted.
South Dakota	Prior registration by written examination in another state, provided the other state accepts S. D. exams. Prior registration on long practice, if there is reciprocal agreement between the two states.
Tennessee	Graduation from approved school, four years practice. Prior registration by written examination. Prior registration on long practice. NBER certification accepted.
Texas	Graduation from an ECPD-accredited course plus at least four years of satisfactory experience. Prior registration by written examination following eight years of satisfactory experience. Twelve years of experience in engineering work of which five years were in responsible charge—provided the applicant was registered in another state prior to 1942 and provided the applicant was not less than 35.
Utah	Prior registration on graduation plus four years of qualifying experience. Prior registration by written examination and eight years of qualifying experience.
Vermont	Graduation from four-year course plus three years of engineering experience. Prior registration in another state.
Virginia	Prior registration in another state of equal qualification requirements, if reciprocal agreement exists. Ten years of responsible, lawful practice, if prior registration was not based on written examinations. Personal interview during one of the regular examination periods in Virginia may be required.
Washington	Satisfying the statutory qualification requirements.
West Virginia	Graduation from an approved school. Prior registration by passing an equivalent written examination in another state. Mature age, long professional experience and outstanding engineering accomplishments, plus an oral examination by the West Virginia Board.
Wisconsin	Graduation from approved school, four years practice. Twelve years of engineering experience, over 35. NBER certification may be accepted.
Wyoming	Prior registration by written examination plus satisfying Wyoming experience requirements. Prior registration under an eminence clause. Prior registration without examination if the applicant is unanimously approved by the Wyoming board.

shouldn't wait until he actually needs a certificate to apply. He should file with the bureau as early as practicable to avoid unnecessary delays in the future. Special forms are supplied.

Here Are the Guides

Two simple rules express the boards' guiding principles when disposing of a request for registration by endorsement:

- Waive written and oral examinations if the applicant has passed a reasonably equivalent written examination in another state.
- Waive written and oral examinations in the case of registered engineers of long established practice and recognized standing in the profession. This assumes, of course, that the applicant meets all other statutory requirements.

NCSBEE through its Committee on Registration by Endorsement has devoted many years of effort to this problem of interstate registration. It is recognized as a problem of education and persuasion. This committee has explored the conditions for registration by endorsement without written examination with the various state boards and has compiled the list of these requirements that accompanies this article. Since requirements change, you'd be wise to confirm these with the board involved.

ATOM EDUCATION . . . More Join In

Urgent need for more men to staff nuclear research and development groups has led nearly 100 colleges to establish at least one course in nuclear technology. About half of these will offer a course for the first time this year, and many others are increasing the scope of their programs this year.

To help them prepare for the new courses, the Atomic Energy Commission, the National Science Foundation and a number of other groups have co-sponsored two eight-week summer sessions to teach faculty members how to incorporate nuclear training into college programs and to deepen the educators' training in the field.

The courses, one at Argonne National Laboratory near Chicago, the other Brookhaven National Laboratory on Long Island, were both very popular with the schools. At Argonne, deans from 80 colleges nominated a total of 168 faculty members. Only 61 could be accepted.

Why the tremendous interest in nuclear education? Let AEC chairman Lewis L. Strauss answer: "To meet our needs for all atomic research and development—both government and industry—we may require new scientists and engineers at a rate somewhere between 2,000 and 3,000 per year. We are now providing only about half of that requirement."

Not only will AEC's courses spur the establishment of new college programs but they'll also boost the quality of intruction in some of the courses set up earlier. Many of these were sketchy, survey-type affairs. More advanced programs in the colleges are also apt to result.

NEXT MONTH

$100,000/YEAR JOBS

Several dozen men in the chemical process industries earn $100,000 or more per year. What makes them worth so much to their companies? A YYJ feature postponed from this month.

What the Press says about the Tanker

"WORLD GLORY"

DESIGNED, BUILT, TURBINED BY BETHLEHEM

N. Y. HERALD TRIBUNE
APRIL 9, 1956

World Glory makes seventeen-knots loaded on 15,000 horsepower, using eighty-three tons of fuel daily.

"This unrivalled efficiency was an important factor in the decision to build the new ship for American flag operation. In the last two years, other tankers of 45,000 tons and more have been built abroad, but this is the first time that one of these mammoth ships will join the American merchant marine."

NEW YORK TIMES
APRIL 9, 1956

Three vessels are to be built in this country and will be registered here. In addition to the super tanker, orders have been placed for two more at 32,000 tons each.

The Niarchos tanker World Glory, slightly smaller than the present ship, was built at the same yard, but for foreign registry. The new vessel's design closely follows the World Glory's. The latter's extraordinary efficiency has attracted great attention. On 15,000 horsepower she develops seventeen knots, using only eighty-three tons of fuel a day.

N. Y. HERALD TRIBUNE
APRIL 17, 1956

The 46,000-ton tanker will be slightly larger than the World Glory built by the same Bethlehem yard for Mr. Niarchos who is operating it under the Liberian flag. The World Glory has established a remarkable record since she went into service two years ago for reliability and economy of operation.

NEW YORK TIMES
AUGUST 26, 1954

The World Glory is very fast afloat and smooth in operation. Her 15,000-horsepower turbines turned out speeds in excess of seventeen knots in all-out trial runs last May, and she managed to better sixteen knots while using only 12,000 horsepower.

Master Is a Veteran

The master of the World Glory, Captain Corcacas said she had handled "like a baby carriage" on her initial trip.

NEW YORK TIMES
MAY 4, 1954

After the vessel docked shortly after 2 P. M. at the Boston Naval Shipyard in East Boston, Captain Smith praised the performance of the tanker, the second largest merchant ship built in this country. The 53,000-gross-ton superliner, United States, built at Newport News, Va., is the largest.

"She performed marvelously," he said.

SHIP REPAIR YARDS

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Baltimore Harbor — Beaumont, Texas
Los Angeles Harbor — San Francisco Harbor

SHIPBUILDING YARDS

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Terminal Island, Calif. — San Francisco, Calif.

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HARBISON-WALKER

These are typical of some of the *NEW* tried and proved refractories:

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the 90% alumina refractory, for high temperature service

An exceedingly unusual refractory designed for service under conditions of soaking heat and exposure to impact and abrasion at high temperatures. It is highly resistant to spalling and the chemical action of a wide range of fluxes.

HARCOR

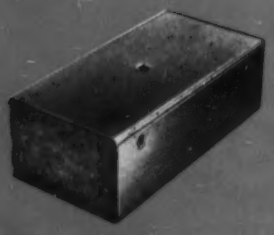
strongest ramming mix

Harcor Ramming Mix develops and maintains unusually high strength, making it outstanding among monolithic materials. It is shipped in dry granular form. After mixing with water and ramming in place, the exceptional strength develops during drying and is maintained to a high degree throughout its service temperature range.

KAOSIL

semi-silica super-quality fireclay refractory

The development of KAOSIL, for the first time, provides a semi-silica fireclay brick of super quality, having many properties of prime importance for chemical processing requirements. Its silica content is approximately 76% with alkali phenomenally low—less than 1%. This composition largely accounts for its high strength in soaking heats. In atmospheres containing volatile alkalies at high temperatures, KAOSIL becomes glazed and penetration is thereby greatly retarded.



METALKASE

steel-encased on four sides

This magnesite-chrome refractory has exceptionally high resistance to corrosion by basic slags and to severe spalling conditions. METALKASE brick are preformed under great pressure and by welding are firmly encased in 22 gauge steel on four sides. In service the steel provides reinforcement and at the exposed ends oxidizes, melts and forms a monolithic surface which further enhances resistance to thermal spalling.

HARBISON-WALKER
AND SUBSIDIARIES

REFRACTORIES

—HAVING CHARACTERISTICS OF SINGULAR MERIT—

can reduce production costs and improve furnace performance

Throughout the chemical processing industries, the economy of correctly applied refractories is fully recognized. Wherever heat is used, refractories are needed to confine and direct it. Experienced operators know that over-all production costs can be materially reduced by the proper selection of refractories.

Harbison-Walker has constantly kept abreast of demands in the development of specialized refractories designed to meet the widely diversified conditions employed in chemical processing operations. In addition to the unusual products listed on the opposite page, several other refractories of special merit are briefly described in the following:

H-W CORUNDUM is an extremely hard-fired refractory consisting entirely of corundum (99+ crystalline alumina). Its properties of particular importance for use under the most severe conditions are high refractoriness, substantially equivalent to that of pure alumina (3700°F.), exceptional volume stability and resistance to fluxing by various corrosive ash constituents and volatile alkalies, at high temperatures.

H-W MULLITE is made synthetically rather than from the natural minerals of appreciably lower alumina content. Its alumina content closely corresponds to that of pure mullite. Because of its high degree of stability and its fully developed mineral composition, H-W MULLITE is unusually resistant to many corrosive slags and fumes. In addition, the superior physical properties contribute to the excellent service secured from this unusual synthetic mullite refractory.

Where corrosive chemical and acid conditions prevail, DURO and W-ACID brands of acid-proof brick provide highly effective resistance.

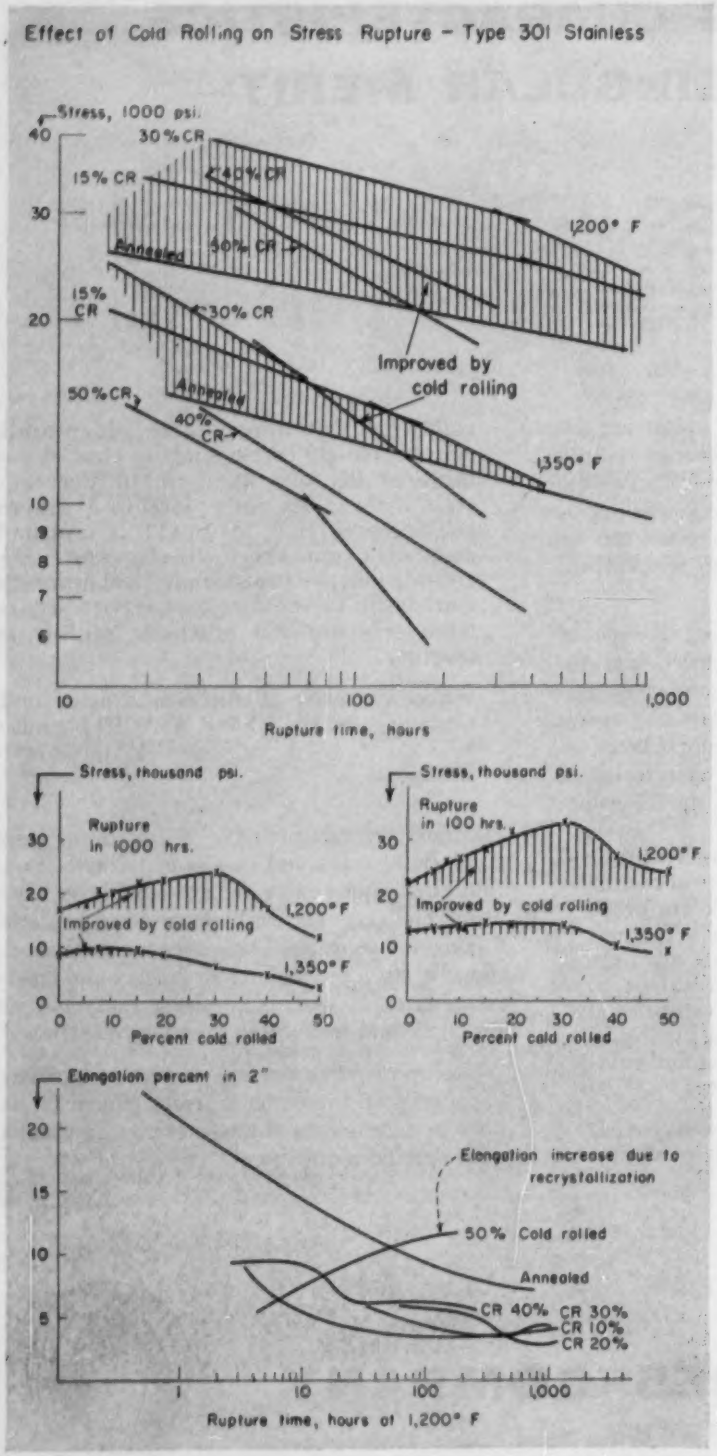
Harbison-Walker produces more than fourscore commercial types and classes of refractories which fulfill the requirements for exceedingly severe operating conditions, such as high temperatures, spalling, fluxing and pressure. These types include all classes of basic, silica, high alumina, fireclay and insulating refractories as well as cements, castables, plastic fire brick and monolithic ramming materials.

Technical service based on the most extensive experience and research is freely offered for assistance in determining the refractories best suited for each specific requirement.

REFRACTORIES COMPANY

World's Largest Producer of Refractories • General Offices: Pittsburgh 22, Pennsylvania

Improved Elevated Temperature Strength



. . . of austenitic stainless steels can be had by cold-working. Up to now, this technique has been used for atmospheric temperature applications only.

R. A. Lula, A. J. Lena, H. M. Johnson
Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Ability of austenitic stainless steels to be work-hardened to high-strength levels has been used to great advantage for many years to provide corrosion-resistant, high-strength materials for structural components which operate at atmospheric temperatures. Outstanding example of this type of material is cold-rolled Type 301 stainless steel which is used extensively for structural applications in automotive truck trailers and railway cars.

In contrast to the wide use of cold-rolled austenitic stainless steels at normal temperatures, there has been relatively little attempt to extend their use to elevated temperatures. This condition has undoubtedly been due to the lack of information describing the effects of cold-working on the strength and structural stability of these materials when subjected to loading at elevated temperatures.

Results of an investigation on the effects of cold-working on the high-temperature properties of the austenitic stainless steels show that significant improvement is possible. Steels chosen for this work were Types 301, 305, and 310—with the major emphasis being placed on Type 301.

Materials and Procedures

AISI Type 301 was initially chosen for this study, with additional work being performed on

This article is based on a paper given by the authors before the semi-annual meeting of the ASME, Cleveland, June 17-21, 1956.

Meet your authors on page 393.

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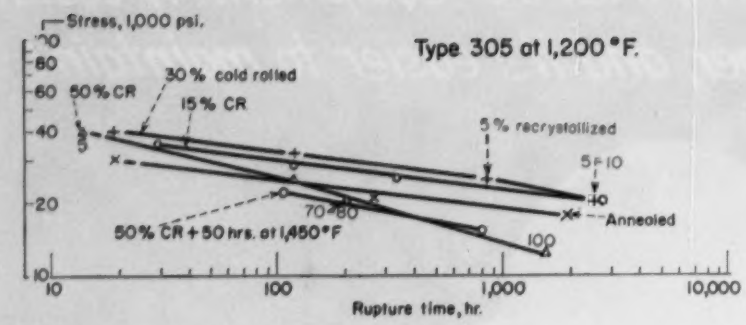

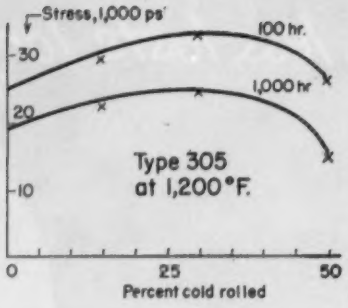

AISI Types 305 and 310 to provide wider coverage of the possible structural changes which can occur in the austenitic stainless steels at elevated temperatures.

Type 301 transforms partially to martensite during cold-rolling. The other two grades are sufficiently stable to remain completely austenitic. Carbide precipitation in the temperature range of 1,000-1,600 F. occurs in all three of these steels, but only in Type 310 does extensive sigma formation take place.

Composition of the three heats which were studied is shown in the table. These steels were received from the mill in the form of annealed strip, and portions of each strip were subsequently cold-rolled various degrees in the laboratory. The table also gives room-temperature properties of the three steels in the annealed and various cold-rolled conditions.

Samples of the annealed and cold-rolled material were studied with respect to structural changes including carbide precipitation, sigma formation and recrystallization. Stress-rupture tests (2-in. gage length) were used to evaluate the effect of cold work on high-temperature properties.

Compositions

Type	C	Si	Mn	Cr	Ni	N₂	Cu
301	0.11	0.30	0.76	17.83	7.17	0.046	0.24
305	0.072	0.31	1.04	17.70	11.88	0.052	....
310	0.065	0.35	1.40	24.58	19.86	0.050	0.16

Room Temperature Tensile Properties

Condition	0.2% Offset Yield Strength Psi	Tensile Strength Psi	% Elong. in 2"
Type 301			
Annealed	33,330	110,775	67.0
CR 5%	61,800	120,350	46.0
CR 7.5%	69,350	127,900	45.0
CR 10%	71,300	128,725	44.0
CR 15%	90,375	150,800	32.5
CR 20%	111,540	165,000	27.5
CR 30%	124,300	166,975	25.0
CR 40%	178,775	196,000	9.0
CR 50%	204,150	217,000	3.5
Type 305			
Annealed	26,445	77,850	77.0
CR 15%	76,200	94,400	42.0
CR 30%	109,120	122,490	20.0
CR 50%	140,530	155,430	4.0
Type 310			
Annealed	39,860	86,700	46.0
CR 5%	62,500	91,870	38.0
CR 10%	86,795	102,000	23.0
CR 40%	126,000	141,800	8.0

Elevated Temperature Properties

▶ **Type 301** — Conventional stress-rupture curves for annealed and cold-rolled Type 301 at 1,200 and 1,350 F. are shown, as are effects of cold work on the 100 and 1,000-hr. rupture strength of this steel at 1,200 and 1,350 F. The following generalizations can be derived from these curves:

• Improvement in elevated-temperature strength derived from cold-working goes through a maximum at some intermediate degree of cold work, the exact value depending on the temperature and time of testing. Maximum strengthening effect is obtained at 1,200 F. with 30% cold-rolling for both 100 and 1,000-hr. rupture life. At 1,350 F., very little improvement in 100 or 1,000-hr. rupture strength can be obtained by cold-working. Large amounts of cold work (greater than 30% for 100-hr. rupture strength, and 20% for 1,000-hr. rupture strength) is detrimental to elevated-temperature strength.

• For a constant rupture life, increase in strength from cold-working is greater the lower the testing temperature. For instance, a 50% improvement in stress for rupture in 100 hr. at 1,200 F. can be obtained by cold-working—whereas the maximum improvement at 1,350 F. for the same rupture life is about 10%.

• Excessive amounts of cold-working can result in rupture strengths less than that of annealed material, with the minimum amount of cold work necessary to do this being dependent upon the temperature and time of test.

Cold-working has a detrimental effect on elongation at fracture in the stress rupture test. An exception to this rule is found in samples which recrystallize. This is shown by the 50% cold-rolled material which had a low initial elongation at very short rupture times, but the elongation increased rapidly thereafter coincident with a rapid rate of recrystallization.

▶ **Type 305** — Stress-to-rupture curves for Type 305 at 1,200 F. are shown. The 100 and 1,000-hr. rupture stress at 1,200 F. is also shown as a function of the amount of cold work.

These results are comparable to those of Type 301 at 1,200 F. in that 30% cold-rolling produces maximum improvement for both 100 and 1,000-hr. rupture life. Rupture strengths of the two alloys are essentially the same in spite of the difference in austenite stability. Stress to rupture in 100 hr. of the 50% cold-rolled Type 305 is

"the answer..."

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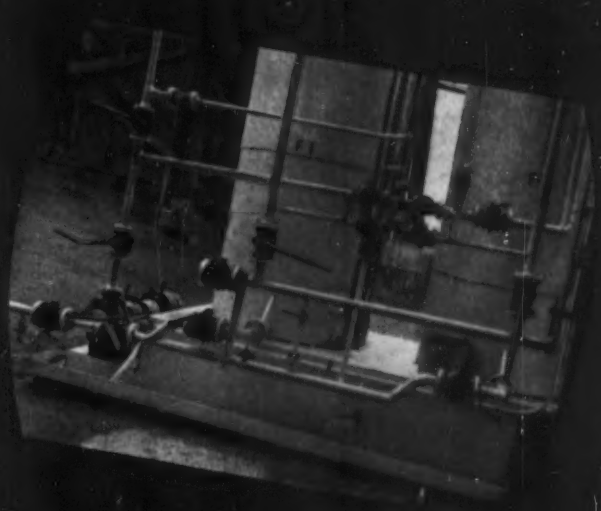
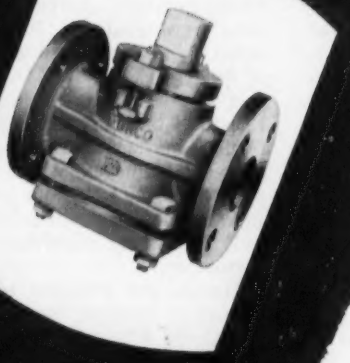
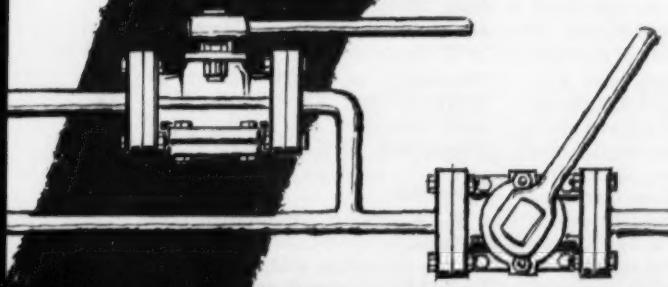
may be the one you've been looking for!



DURCO type F valves





For handling fuming red nitric acid, Durco Type F Valves have proved to be THE answer for Hercules.

On the manifold pictured above, there are nineteen Durco Type F Valves. These Durimet 20 valves have been in service more than three years . . . that is *trouble-free* service for more than three years. The pump is a D3RD Durcopump.

Hercules Powder Company is a leading producer of acids, anhydrous ammonia, and other ammonia products, cellulose products, resins, terpene chemicals, rosin and rosin derivatives, chlorinated products, industrial explosives, and many other materials. Since first using this type valve in their Hercules, California plant early in 1952, this Hercules plant has placed more than thirty repeat orders, in varying quantities, for Durco Type F Valves.

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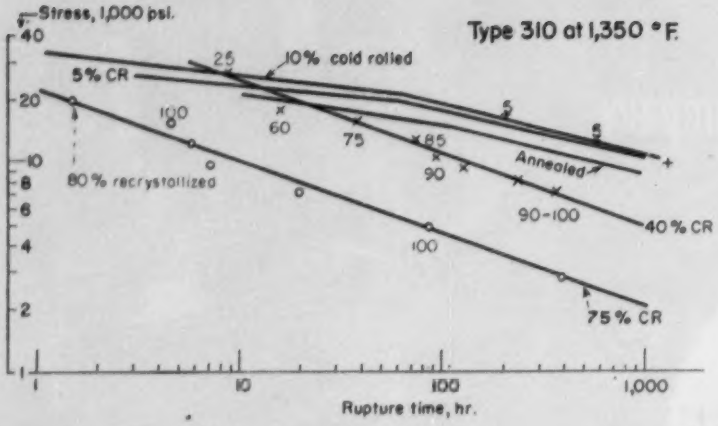

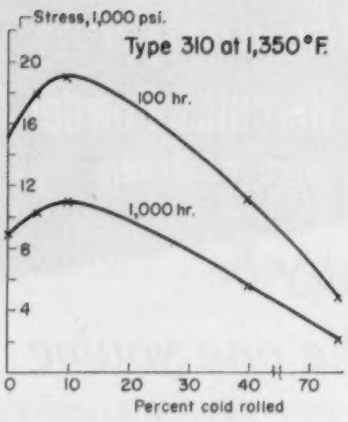

about the same as that for annealed material, but is substantially less than that for annealed material for rupture in 1,000 hr.

▶**Type 310**—Stress-to-rupture properties of Type 310 at 1,350 F. are shown. Minor improvement at this temperature is obtained with 5 and 10% cold-rolling, with rupture lives of 100 and 1,000 hr.

Stress-rupture properties of material cold-rolled either 40 or 75% is definitely inferior to that of annealed material for both 100 and 1,000 hr.

This effect is due to recrystallization, which occurs very rapidly in heavily cold-rolled materials at high temperatures having a detrimental effect on strength as will be described later.

Information on the effect of intermediate degrees of cold work between 10 and 40% was not obtained, but the data on Type 301 at 1,350 F. indicate that no further improvement in strength would be expected in this range.

Structural Modifications

Metallographic examination of fractured test pieces has shown that recrystallization is the major structural change which affects the elevated temperature strength of the cold-rolled austenitic stainless steels. When recrystallization begins, the rupture strength decreases. In general, when recrystallization exceeds 50 to 60%, strength is less than that of annealed material. Effect of recrystallization can be seen on the stress-rupture curves for Types 301, 305 and 310, where the percentage of recrystallization for fractured test pieces is indicated.

Several structural modifications associated with recrystallization were observed in this study. First of these, of course, was a change in grain size which in general resulted in a refinement of grain size. This was particularly true of heavily cold-worked samples which underwent rapid recrystallization and suffered rapid deterioration of elevated-temperature strength.

Initial recrystallization in heavily cold-worked samples produced a high concentration of very fine grains at the boundaries of the cold-rolled steel. Photomicrographs indicate the partial disappearance of the chromium-carbide phase as recrystallization progresses. The resolution of chromium carbide was common to each of the three types of stainless steels.

Type 310 is unlike Types 301 and 305 in that it is capable of developing large quantities of sigma when exposed at elevated temperatures. It has been previously shown[1] that recrystallization of cold-worked samples during static aging accelerates the formation of sigma. This effect was also observed in fractured test pieces of Type 310 which had recrystallized in test.

Owing to the instability of Type 301, it transforms partially to martensite during cold-working to the extent that approximately 15% of this phase is found in this alloy when cold-rolled 30%. The presence of martensite is believed to contribute materially to room-temperature strengthening.

To ascertain if this phase is retained during stress-rupture testing (and hence could contribute to high-temperature strengthening), dilatrometric tests were made on 30% cold-rolled Type 301 heated at a rate of 66 deg. F. per hr. An inflection in the heating curve at 770 F. establishes the temperature of transformation of martensite to austenite. The expansion coefficient between 1,100 and 1,400 F. is the same as for annealed Type 301, indicating complete transformation.

Hence, the presence of martensite at elevated temperatures cannot be a factor in the high-temperature properties of this grade. Further evidence for this is shown by the similarity in behavior between Type 301 and 305 in spite of the large difference in stability of the two steels. Type 305 when cold-rolled 30% contains less than 0.5% martensite as determined by a magnetic test. Type 301 in the same condition will contain approximately 15%.

Evaluation

It is possible to improve the elevated-temperature properties of the austenitic stainless steels by cold-working, providing the degree of cold work and con-

SOMEBODY GOOFED!

Only by a freak of fortune does the leaning tower of Pisa still stand. A faulty foundation was not apparent until the structure was three stories high. It is believed the architects were then forced to compensate by adding weight to the opposite side to save the building.

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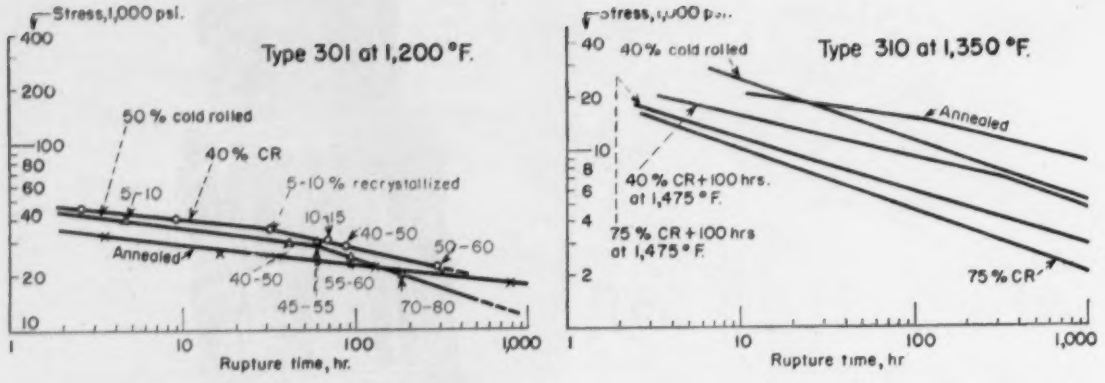

ditions of exposure are not conducive to extensive recrystallization. Although the rupture strength begins to decrease with the beginning of recrystallization, improvement in strength is retained until the amount of recrystallization exceeds approximately 50%.

An attempt was made in this study to determine why recrystallization exerts such a marked decrease in the stress-rupture properties of cold-rolled steels. One would expect that restoration of an annealed condition through recrystallization would produce strengths equivalent to steels tested as annealed.

However, the data has shown that complete recrystallization in cold-worked materials results in properties which are definitely inferior to annealed materials. This fact indicates that the actual recrystallization process during testing or structural modifications which are produced by recrystallization are detrimental to high-temperature strength.

With respect to recrystallization, *per se*, it has been suggested[2] that accelerated creep should occur during recrystallization because of greater atomic mobility. This postulation has since been confirmed for a number of pure metals.

To investigate this possible effect in cold-rolled stainless steels, samples of 305 and 310 were cold-rolled, recrystallized by aging at 1,450 or 1,475 F. and subsequently tested at 1,200 or 1,350 F. Results are shown in the stress-rupture curves on p. 238 and p. 240.

For both materials, the rupture curves of samples recrystallized prior to testing are well below the annealed curves for all rupture lives. Furthermore, the 1,000-hour rupture strength of samples which were recrystallized prior to testing are substantially the same as those with equivalent amounts of cold work which recrystallized during test.

As a result of these experiments, it can be stated that the structural modifications which occur as a result of recrystallization are harmful to high-temperature strength regardless of whether or not the recrystallization occurs during the test or prior to testing. These microstructural changes include a refinement in grain size and modification of carbide precipitation in all three steels, and accelerated sigma formation during recrystallization in 310.

Summary

• Cold-working increases the rupture strength of Types 301, 305, and 310 stainless steels —providing the degree of cold work and conditions of exposure are not conducive to extensive recrystallization.

• Increase in strength derived from cold-working is greater the lower the testing temperature.

• Optimum amount of cold work for beneficiation is dependent upon testing temperature and time, and decreases with increasing time at a given temperature or with increasing temperature at a given time.

• Beneficial effect of cold-working on high-temperature strength persists through the recovery period prior to recrystallization.

• Recrystallization results in a substantial decrease in high-temperature strength of cold-worked austenitic stainless steels. The improvement in rupture strength obtained by cold-rolling is gradually lost with increasing amounts of recrystallization. Stress-rupture values of cold-rolled materials drop below that of the annealed values with more than 50-60% recrystallization.

• Decrease in rupture strength due to recrystallization is due to structural modifications which occur as a result of recrystallization. These modifications include changes in grain size and carbide distribution in Types 301, 305 and 310 as well as the accelerated formation of sigma in Types 310.

• Martensite produced by cold-rolling in unstable austensite stainless steels such as Type 301 transforms to austensite at testing temperatures, and cannot contribute to high-temperature strengthening.

REFERENCES

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2. Becker, R., Zeit. Tech. Physik, vol. 7, 1926, p. 547.

NEXT MONTH

TESTING LEAD LININGS

See next month's Corrosion Forum for the latest testing and inspecting techniques on lead linings.

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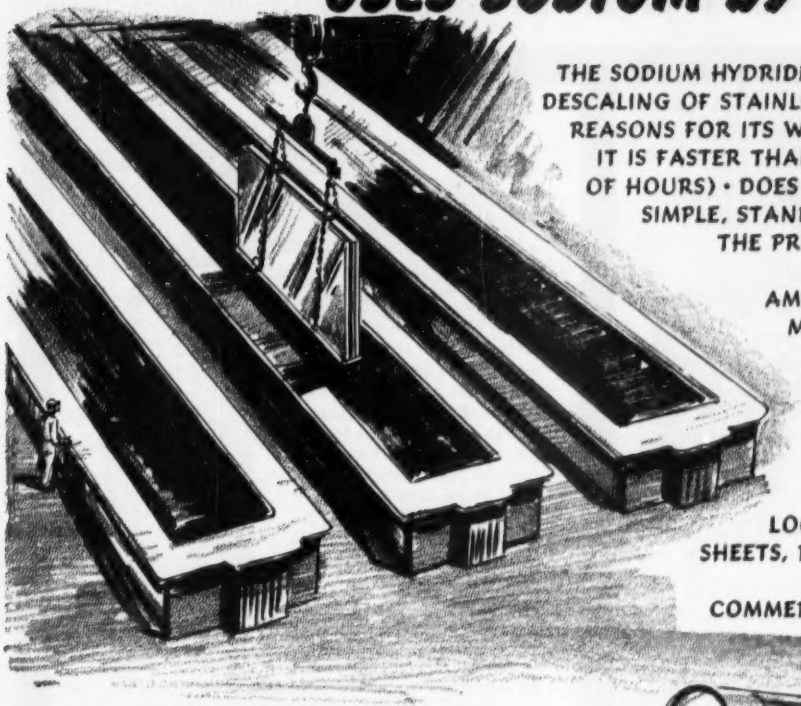
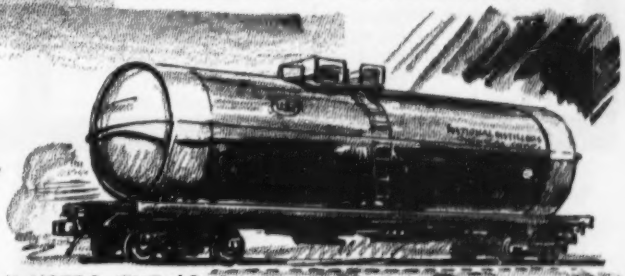
METAL DESCALING USES SODIUM BY THE TON



THE SODIUM HYDRIDE PROCESS HAS STREAMLINED DESCALING OF STAINLESS STEEL AND OTHER METALS. REASONS FOR ITS WIDE AND RAPID ACCEPTANCE: IT IS FASTER THAN PICKLING (MINUTES INSTEAD OF HOURS) • DOES NOT BITE THE METAL • USES SIMPLE, STANDARD EQUIPMENT.

THE PROCESS: HYDROGEN (USUALLY PRODUCED BY DISSOCIATING AMMONIA) IS BUBBLED THROUGH MOLTEN SODIUM TO FORM THE HYDRIDE, WHICH IS THEN DISSOLVED UP TO 2% IN A CAUSTIC BATH AT 700°C. THE METAL IS DIPPED, AND THE REDUCED SCALE THEN KNOCKED LOOSE BY COLD WATER QUENCH. SHEETS, RODS, WIRE, STRIP, STAMPINGS HAVE ALL BEEN DESCALED COMMERCIALLY VIA SODIUM HYDRIDE.

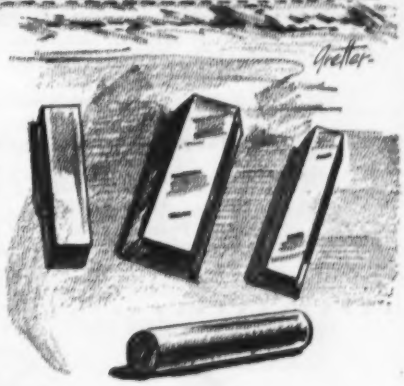
SODIUM AS YOU LIKE IT



NO MATTER WHAT YOUR SODIUM APPLICATION—PLANT, PILOT OR LAB SCALE—U.S.I. MAKES THIS METAL AVAILABLE IN THE FORM AND SIZE YOU NEED.

THERE IS THE GIANT ECONOMY PACKAGE FOR BULK USERS—THE 40-TON TANK CAR OF SOLID MATERIAL. SODIUM IS ALSO PACKAGED CAST SOLID IN 55-GAL. STEEL DRUMS OR 5-GAL. STEEL PAILS.

THEN THERE ARE THE BRICK FORMS—IN 12, 5, 2½ AND 1-LB. SIZES—PACKED DRY IN 55-GAL. STEEL BARRELS. FOR SMALL USERS, 1-AND 2-LB. BRICKS CAN BE PURCHASED IN STEEL PAILS CONTAINING 20-LB. OF SODIUM. MORE DETAILS IN THE U.S.I. BOOK, "HANDLING METALLIC SODIUM ON A PLANT SCALE". WRITE FOR YOUR COPY.



Metal Strength Through Sodium

SODIUM ADDED IN SMALL QUANTITIES (0.05%) TO ALUMINUM-SILICON CASTING ALLOY YIELDS REFINED GRAIN STRUCTURE, GIVING IMPROVED TENSILE STRENGTH AND ELONGATION. SODIUM HAS ALSO BEEN USED AS A DEOXIDIZER FOR BRASS AND COPPER AS WELL AS THE REFINING OF LEAD.

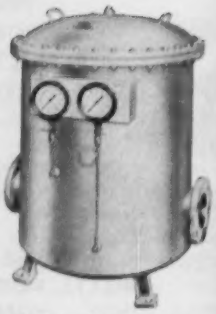
U.S.I. INDUSTRIAL CHEMICALS CO.

Division of National Distillers Products Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

CFC COMPLETE FILTRATION COVERAGE

there's a Commercial Filters unit engineered for your filtering job...

Fulflo FILTERS



Fulflo Filters provide optimum clarity at ultra-high flow rates. For all industrial fluids—including oils, liquid fuels, chemicals, water, compressed air and various gases. Sizes to handle flow rates up to 1,600 gpm. Pressures to 4,000 psi.

Fulflo Filters feature Honeycomb Filter Tubes, the "precision controlled density" element that filters every drop again and again to give you microscopic clarity. Choice of cotton, acetate, nylon, orlon, dacron, dynel or glass fibres.

Standard models available in steel, stainless steel, rubber lined steel or nickel-plated brass. Custom models engineered to special requirements.

Honan Crane FILTERS

Honan-Crane Filters offer "clean oil" filtration in diesel, turbine, hydraulic, metalworking and quenching operations. Bulk refill models provide depth filtration with cellulose medium for additive oils and Cranite (fullers earth) medium for straigth mineral oils. Multi-cartridge models feature six different types of cartridges that may be used interchangeably depending on type and degree of filtration desired. Flo-Pac models, installed in line, handle flow rates up to 900 gpm. All have quick-opening covers for ease in changing refills.

other CFC products

Purivac Insulating Oil Conditioners
High Pressure Hydraulic Filters
Magnetic Separators
Plating Filters
Coolant Clarifiers
Oil Burner Filters
Compressed Air Filters
Dri-Pure Water-Oil Separators
Pre-Coat Filters
Water Filters
Beverage Filters
Pharmaceutical Filters
Automatic Tubular Conveyors

FILTERS Michiana

Diesel and gasoline engines get complete protection against the damaging effects of dirty oil with Michiana Lube and Fuel Oil Filters. Designed for low cost filtration and proven in thousands of installations. "Throw-away" or repackable filter elements. Available in a wide range of sizes and models.

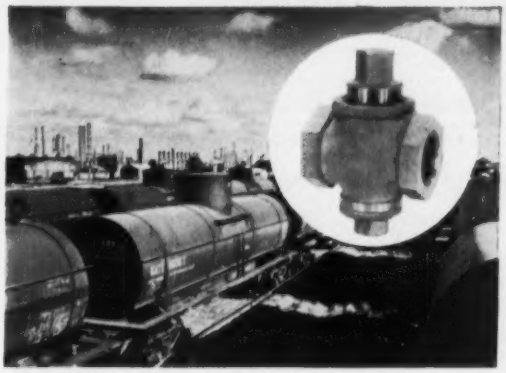
Write for literature or engineering help covering your filtration problem.

CFC

COMMERCIAL FILTERS CORPORATION

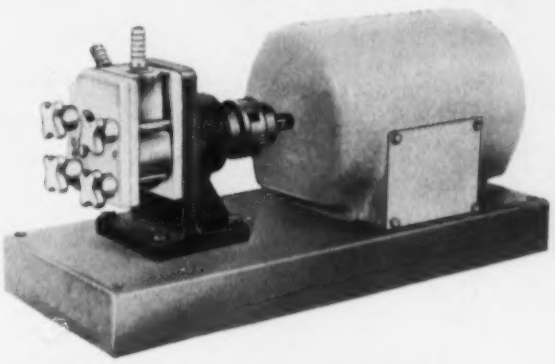
MELROSE, MASSACHUSETTS • LEBANON, INDIANA

CORPORATION BRIEFS



PLUG COCKS WITH V2B

Plug cocks on the tank car unloading connections presented General American Transportation Company with an expensive recurring maintenance problem. Galling made them unusable in a short period of time and any lubrication would contaminate the products transported. The problem was to find a cock or valve which would supply the corrosion resistance needed, but would not gall. Prior to the development of Cooper Alloy's patented V2B, there was no economical answer. According to Chief Engineer H. E. Tidswell V2B plugs saved the day. The high corrosion resistance, hardenability and machinability of this special alloy has permitted the manufacture of stainless plug cocks which do the job perfectly. Technical data on request.

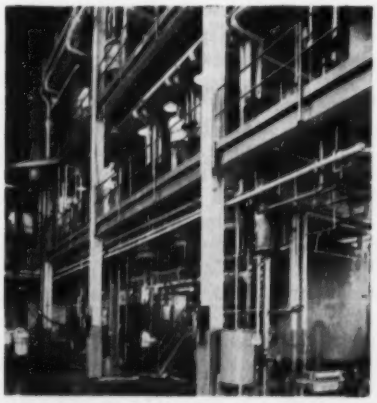


SEAL-LESS SANITARY PUMPS

The new XB-SAN series of Sani-Flex Sanitary pump units for handling food products, pharmaceuticals, corrosive solutions and abrasive slurries has been announced by our affiliate Vanton Pump.

The unique action of the sanitary pump isolates the fluid from all rotating parts, causing it to pass on the outside surface of a tasteless and odorless neoprene liner and the inside surface of a type 304 or 316 polished stainless steel body block. The pumping action is gentle, avoiding churning, foaming or breakdown of the fluid. The absence of stuffing boxes or shaft seals of any sort eliminates the possibility of contamination as well as leakage.

Sani-Flex pumps can be furnished driven by electric, air or variable speed motor equipment. Capacities available are fractional through 20 gpm. Literature on request.



NEW PFIZER DRUGS EASE ARTHRITIS, BURSITIS

The pain and crippling effects of arthritis and bursitis are now being relieved through the use of the new drugs Cortril and Sterane. Both of these Pfizer-developed drugs are steroid chemicals similar to hormones in action. Sterane has the same therapeutic range as Cortril but is five times as potent.

Charles Pfizer manufactures these drugs by careful fermentation and controlled biological reaction, but starts with the gathering of yams in the jungles of semitropical countries. Cooper Alloy is proud that throughout an extensive part of the processing involved, our stainless steel valves are used to insure product purity and production continuity.

COOPER ALLOY

CORPORATION · HILLSIDE, N. J.

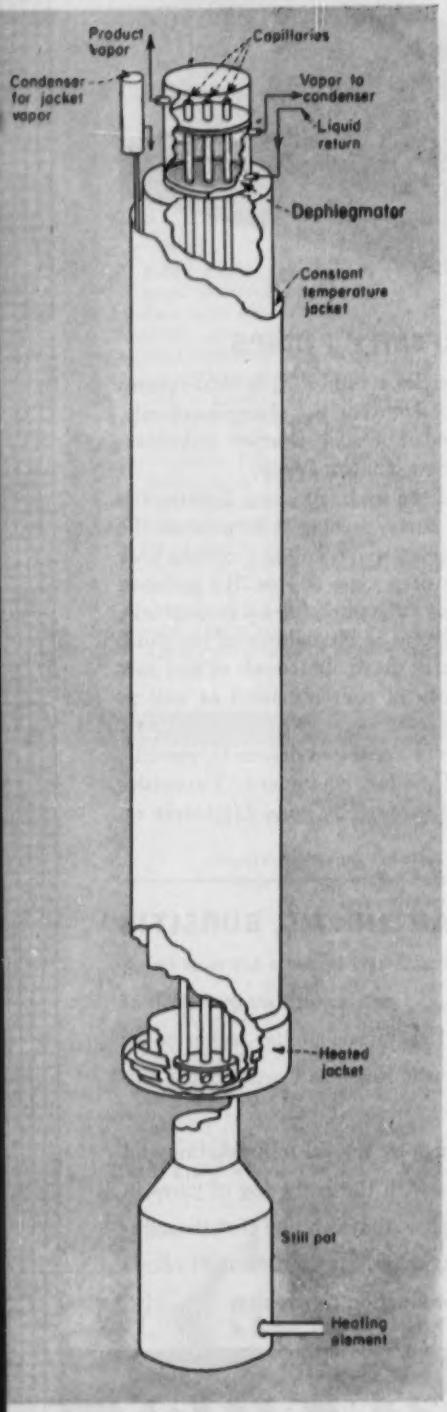
Divisions

FOUNDRY PRODUCTS DIVISION · VALVE & FITTING DIVISION · VANTON PUMP & EQUIPMENT CORP.

STAINLESS ENGINEERING AND MACHINE WORKS DIVISION · AIRCRAFT PRODUCTS DIVISION

EDITED BY C. B. CRONAN

New Column Splits Close-Boiling Liquids



Mixtures of liquids with boiling points less than a degree apart can be separated precisely by the Kuhn column. Special features provide required control.

Precision is a way of life with the Swiss, makers of fine watches and instruments. Now, a Swiss firm is offering to industry a precision rectification column that hits new performance levels.

What the Kuhn column does better than previous columns is to separate difficult mixtures of liquids into pure products in a single operation. It's said to provide up to 400 theoretical plates for separating liquids that differ less than a degree in boiling point. While other columns operating on such materials may achieve some success they do not always produce pure products.

Where boiling points differ by a good margin, the Kuhn column operates with high throughput and one or two theoretical stages. Despite this versatility, the column will likely find greatest use on difficult separations that cannot be handled by other columns.

Column was developed by Prof. W. Kuhn at Basle University, Basle, Switzerland in cooperation with Sulzer Bros., Ltd. Either semi-industrial or the larger industrial columns now are available in Europe and the United States through Sulzer Bros.

▶**Columns Within Column**—When you look at the Kuhn column you see a whole bundle of small-diameter tubes rising within the column, like columns within a column. Internal surfaces of the tubes provide the wetted surface for contact between descending liquid and rising vapor.

At the top of the column the tubes pass through a boiling condenser or dephlegmator. Each tube ends in a short capillary that discharges into a vapor chamber.

Around the column is a vapor jacket to hold the entire column at constant temperature. The space inside the jacket around the tubes may be filled with air, insulation or a boiling liquid.

▶**On Vapor Trail**—Liquid mixture in the still pot is heated to drive vapor up into the column. The vapor flows uniformly through all the tubes to reach the dephlegmator section at the top of the column. Here is condensed any of the higher boiling component which may be present in the vapor.

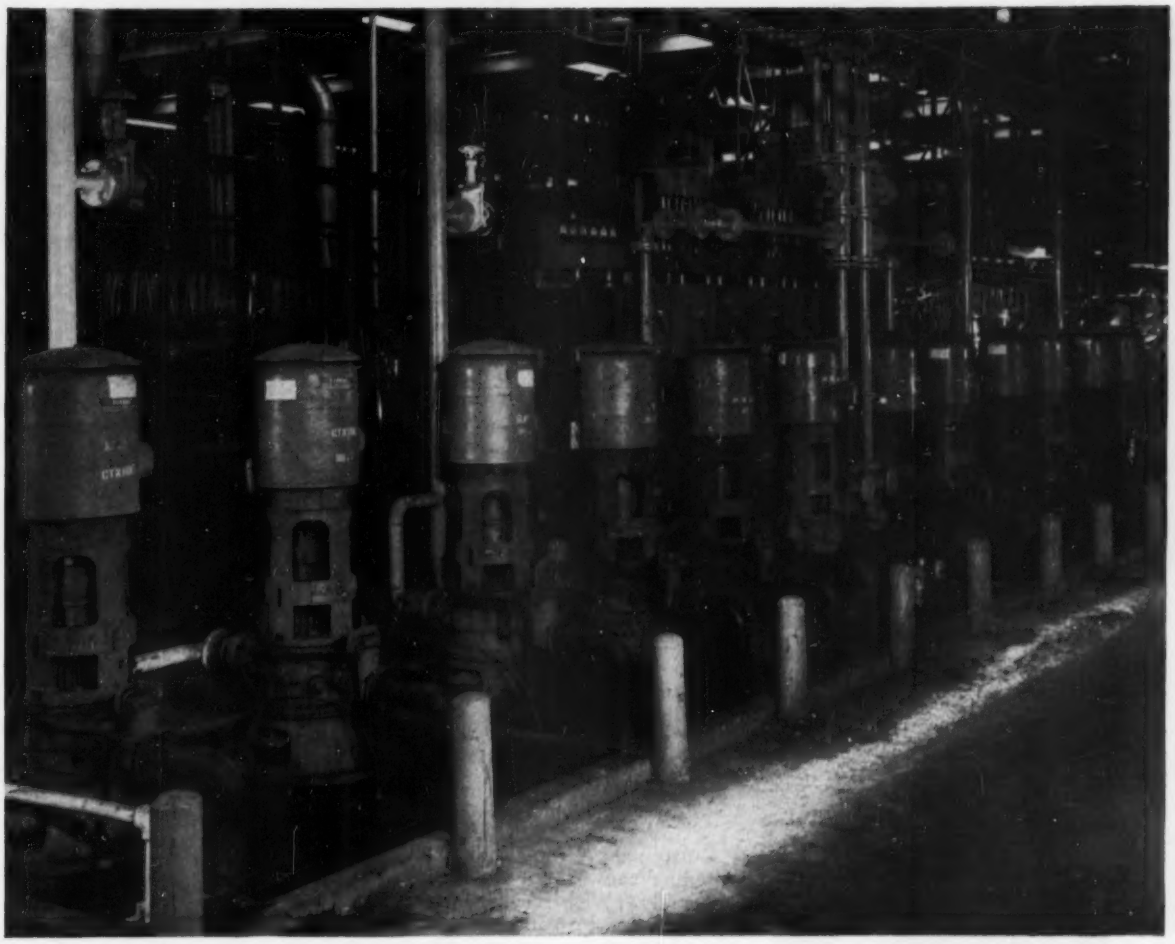
Condensed high boiler drains down the tube walls as a reflux. Pure vapor of the lower boiling compound escapes from the ends of the capillaries, and thence to the product condenser.

▶**Control Point**—What happens at the dephlegmator governs the way the column operates. The temperature of the dephlegmator determines the distilling temperature and the pressure in the Kuhn column.

When the rising vapor partially condenses on the tube walls in the dephlegmator, its latent heat boils the liquid surrounding the tubes. Boiling holds the tube walls at constant temperature. Vapor from the boiling liquid is condensed in a separate condenser and returned to the dephlegmator.

Dephlegmator liquid is selected carefully to give exactly the right condensing temperature so that a pure product is separated from the mixed vapor. Water can be used and the pressure controlled to make it boil at the desired temperature.

Condensation of reflux di-



They Knew What They Wanted

The twelve LaBour Type G pumps in this picture are handling plating solutions and waste, acid and alkaline, in a large Michigan plant producing small hardware for automobiles. In this highly competitive business every penny of cost is scrutinized with a thorough-going care not always found in other industries. The fact that this company chose LaBours is evidence that they expect minimum over-all costs.

As this is written the twelve pumps have been operating on a two-shifts-per-day basis for eight months with no trouble. Since these are LaBour *packingless* pumps, maintenance has been virtually nil.

If you are trying to hold costs down—and who isn't, these days?—it will pay you to investigate LaBour pumps for handling your corrosive and other difficult liquids. We can show you some mighty interesting performance facts and figures.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

THE LABOUR COMPANY, INC. • Elkhart, Indiana, U.S.A.

Newsworthy Equipment This Month

Equipment Cost Indexes, p. 250

New Processing Equipment

Rectifying Column 246A
Solids Feeders 248A
Foam Maker 250A
Low Temperature Dryer 250B
Ball Mill 250C
Agitators 250D

New Materials of Construction

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Gasketing Material 252B
Rivet Fasteners 252C
Aluminum Jacket 252D
Insulation Blanket 252E
Non-Skid Tread Plate 252F
Gratings 252G

New Instruments & Controls

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Flowmeter 254B
Sight Glasses 254C
Thickness Gage 254D
Selective Gas Analyzer 254E
Proportioning System 256A
Vacuum Gage 256B
Pocket pH Meter 256C
Load Cell 256D
Temperature Controller 256E

New Fluids Handling Equipment

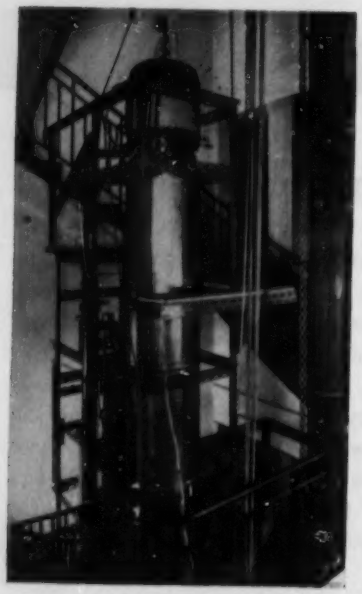
Drum Rack 258A
Rupture Disk 258B
Nylon Tubing 258C
Oxygen Pump 258D
Axial Fans 258E
Vacuum Gate Valves 258F
Process Pump 260A
Air Intake 260B
Loading Arm 260C
Turbine Pump 260D

New Electrical & Mechanical Equipment

Electrical Tape 262A
Gearmotor 262B
Electrical Connector 262C
Slip-Type Drive 262D
Pipe Clamp 262E

Page number is also Reader Service code number

For more details, use Reader Service Card



TOP of Kuhn column, tube bundle on right.

rectly within the tubes assures uniform distribution of the liquid for satisfactory contact with the rising vapor. This characteristic overcomes a basic weakness of previous wetted-wall column designs that have been built.

▶ Continuous, Too—Industrial columns can be operated continuously. With bronze wire-mesh packing, throughput will be 30-50 times greater than without packing. Pressure drop is 2-10 mm./m. tube length (1 in. tubes).

Operation without packing must be batchwise because the film must be continuous for the full length of the tubes. Tests can be run with a single tube and the results scaled up directly to production size with complete confidence.

▶ Commercial Units Underway—To date, isomers of xylene and chlorotoluene, and water-heavy water mixtures have been separated successfully on small-scale operations. A two-stage system to produce about 1.5 tons per year of 99.8% heavy water from a 1.0% feed is reported under construction for a nuclear installation.

Sulzer feels that the Kuhn column will gain recognition handling separations that couldn't be done previously or separations that are marginal for older columns.—**Sulzer Bros., Ltd., New York, 50 Church St., New York, N. Y.** 246A

Solids Feeders

Feed accurately up to 20 tons per hr.

A wide range of solids can be fed at rates up to 20 tons per hr. within ±½% of the set rate by the L-I-W feeder.

These feeders are integral control systems which incorporate the sensing, comparing and correcting elements of the most advanced instruments. Loss-in-weight feeding principle insures proper delivery of materials and accurate record of performance because memory is built in.

Hopper containing several hours' supply of material is mounted on a scale lever system and counterbalanced by a counterpoise traveling on a calibrated scale beam. A lead screw retracts the counterpoise along the scale beam at a rate corresponding to the desired rate of feed.

Any deflection of the scale beam from its set point actuates a pneumatic controller which either speeds up or slows down the feeding mechanism. Thus, the feeder maintains itself in balance automatically and con-

HIGH CAPACITY CLEAN DISCHARGE WITH EIMCO PAN FILTERS

Detail of Eimco stainless-steel pan-filter showing flexible vacuum and blow connections to each pan. These are exclusive features on the Eimco Pan Filter — particularly advantageous when the slurries filtered require periodic clean-outs of internal parts.

Greater filtering capacity, cleaner discharge and superior washing and drying make the Eimco Pan Filter a highly efficient unit.

Each pan functions as an individual filter with feed, wash, dry and discharge cycles. The pans may be jet washed from the bottom, assuring a clean media during every revolution.

Eimco Pan Filters can be constructed from a wide range of materials to ensure long life and low maintenance when processing corrosive slurries. Materials such as rubber, plastic and many others may be bonded to the surface of the metal construction for protective coating or to prevent product contamination.

Pan filters are available in a variety of sizes from 10 to 500 square feet of filter area.

These and other outstanding features listed below in a comparison with table filters, make the Eimco Pan Filter the most practical and efficient horizontal type vacuum filter available.

	TABLE FILTERS	EIMCO PAN FILTERS
Cake Discharge	Heel of cake remains on media.	Clean, full cake discharge.
Washing	No clear separation of wash. Cake remaining on media carries liquor past cake discharge point, diluting the strong filtrate.	Absolute separation of wash.
Media	Becomes blinded easily. Must stop to remove cake and wash. (Phosphoric acid operation requires considerable downtime.)	Media kept clean through wash during each cycle. Downtime minimum.
Removing, Repairing Media	Difficult repair job.	Media on each pan is easily and quickly changed or repaired.

Let Eimco engineers consult with you on your filtration problem. For years they have made it their business — through research — to offer better liquid-solid separation through filtration.

THE EIMCO CORPORATION

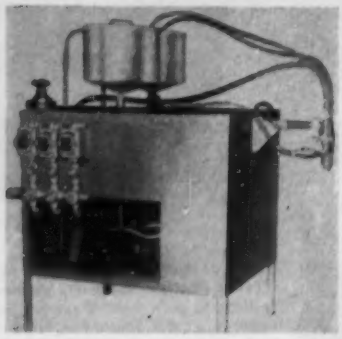
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-209

tinuously, insuring uniform feeding.

For the higher feed rates a duplex feeder is used so that one hopper can be filled while the other is being emptied.—**Omega Machine Co., Div. of B-I-F Industries, Inc., 345 Harris Ave., Providence 1, R. I. 248A**



Foam Maker

For rigid and flexible polyurethane foams.

Design of a new polyurethane foam maker is reported to be greatly simplified. These machines will be offered soon in various capacities from large production models to small portable units.

All machines can be set easily to produce either flexible or rigid foams with a wide range of properties to meet the need of a multitude of end uses. Components from separate tanks above the machine feed by gravity to variable-speed positive displacement pumps which proportion the components exactly ahead of the mixing head.

Mixed, foamed material may be fed immediately into molds. Or discharge at the mixing head may be mounted on extension lines for foamed-in-place operation.—**Klauder Williams Co., Adams Ave. & Leiper St., Philadelphia, Pa. 250A**

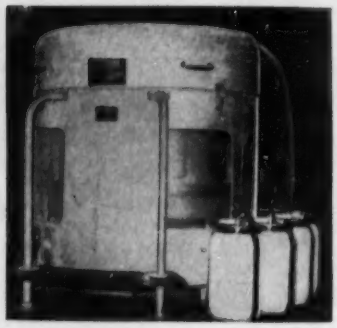
Low-Temperature Dryer

Both dries and cools solid granules or powders.

Through addition of a lithium chloride system the new Turbo Dryer Cooler both cools and dries free-flowing, granular or powdery solids.

Feed enters the Turbo Dryer Cooler at the top and moves downward from one rotating shelf to another. Alternate piling and spreading of the material promotes cooling and prevents lumping without producing fines.

Atmosphere within the unit is dehumidified by lithium chloride solution flowing over fin cooling coils. Moisture-laden lithium chloride is circulated through a regenerator then returned to the dryer-cooler.—**Wyssmont Co., 2700 East Bridge Plaza South, Long Island City, N. Y. 250B**



Ball Mill

Uses centrifugal force to speed grinding.

Through the application of planetary motion the new Steel-Shaw ball mill uses centrifugal force either to make a standard grind much faster or reduce particles to much finer sizes with improved dispersion. English experience with this mill indicates it will perform a conventional 40-hr. grind within four hours.

The Steel-Shaw mill uses four individual pots or jars arranged on the periphery of a cage which revolves around a central shaft. Each jar also rotates simultaneously on its own driving shaft.

Steel-Shaw mills are available either in production or laboratory sizes. On the production mill, each jar holds 6 gal. With an average charge of 50%, the capacity of the mill is 12 gal. per cycle. However, the mill's ability to save up to nine-tenths of production time makes it comparable to a fairly large conventional mill.—**Kinetic Dispersion Corp., 95 Botsford Pl., Buffalo 16, N. Y. 250C**

Agitators

For heavy duty, have new centrifugal vapor seals.

A line of heavy duty brine agitators has been modified to include unique, patented centrifugal vapor seals. Operated by centrifugal force, the new seals positively prevent entry of liquid through the mounting flange. Vapors cannot enter the motor and ball bearings. It is claimed that these seals do not require adjustment, maintenance or replacement.

Agitators are powered by the latest NEMA totally enclosed fan-cooled motors, rated ¾ to 3 hp. at 1,200 rpm. Capacities are 380 to 2,000 gpm. at low pressure heads in pipe sizes from 6 to 12 in.—**Ruthman Machinery Co., Cincinnati 2, Ohio. 250D**

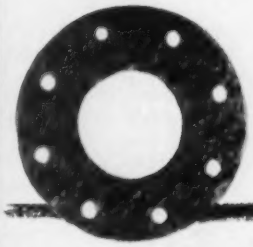
For More Information...

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

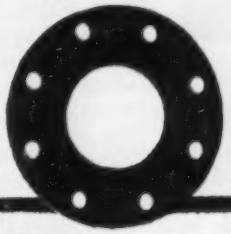
Equipment Cost Indexes

Industry	Mar. 1956	June 1956
Avg. of all	201.3	204.2
Process Industries		
Cement mfg.	192.5	194.8
Chemical	201.9	204.3
Clay products	187.0	189.2
Glass mfg.	190.7	193.0
Paint mfg.	194.3	196.6
Paper mfg.	194.6	196.7
Petroleum ind.	198.5	200.7
Rubber ind.	200.8	203.2
Process ind. avg.	198.4	201.4
Related Industries		
Elec. power equip.	203.8	206.2
Mining, milling	203.2	205.6
Refrigerating	224.9	229.0
Steam power	190.2	192.5

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See Chem. Eng., Nov. 1947, pp. 124-6 for method of obtaining index numbers; March 1956, pp. 194-5 for annual averages since 1913.

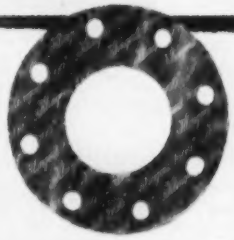


"KLINGERIT" The universal sheet packing for super-heated and saturated steam, acids, alkalis, and other chemicals, oils, spirits, solvents and hydrocarbons, hydraulic pressures, compressed air and other gases.

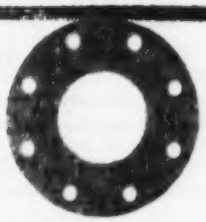


"KLINGER-OILIT" Primarily for use in the oil industry and suitable for trichlorethylene, carbon tetrachloride, naphtha and many other chemicals up to 900°F. Also for use with many refrigerants. It is made mainly from inorganic materials and is suitable for the highest temperatures and pressures.

"KLINGER-ACIDIT" For hot nitric, hydrochloric, sulphuric and all other organic and inorganic acids. It is not damaged by oils, gasoline and other solvents and has been tested to 500°C and 1,000 p.s.i.



"KLINGERIT-1000" Has as its base a tough close-mesh wire gauze in specially prepared asbestos compound, forming an extremely strong homogeneous jointing material. It is better able to resist blowing out than any other jointing, and is recommended for extremely high temperatures.



"RK" For most conditions of pressure and temperature encountered in general engineering practice. It is suitable for super-heated and saturated steam, water, compressed air and other gases and most chemicals.

Write for the Klinger Master Catalog which describes the complete range of Klinger products.

Klinger
COMPRESSED
ASBESTOS SHEET PACKING
FOR EVERY PURPOSE

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95, RIVER STREET, HOBOKEN, NEW JERSEY, U.S.A.
Telephone: HOBOKEN 2-7915 — Cable: KLINGDALE

Distributors and Agents in principal cities. 614/56/51

Cementable Teflon

Can be bonded with standard adhesives.

Teflon now is available in sheets and tapes which can be cemented to most materials by using standard commercial adhesives. Good bond strengths are obtained between the cementable Teflon and aluminum, mild steel, wood and regular Teflon. Thus, it can be used with ease as a lining and covering for tanks, piping, fittings, rolls and other metallic and non-metallic surfaces.

Cementable Teflon sheets and tape are non-porous and uniform in thickness. Sheets come in sizes to 24 x 24 in. and thicknesses up to 2 in. Tapes are available in any length, widths from ½ to 12 in. and thicknesses up to 0.125 in.—**John L. Dore', Inc., Houston, Tex.** 252A

Gasketing Material

Has outstanding properties and definite economy.

Teflon-Vistex gasketing material consists of plies of mechanically interlocked synthetic fiber felt impregnated with Teflon resin. Thus, the exceptional thermal and chemical properties of Teflon now are available in a gasketing material with low cold-flow characteristics.

Two types of material are manufactured. Type W is a tough, exceptionally high tensile strength material for general purpose use. Type NS is a moldable material especially suited for applications involving irregular flange surfaces and pressures. Thicknesses range from ⅛ to ¼ in.—**American Felt Co., Glenville, Conn.** 252B

Rivet Fasteners

Seal themselves automatically against leaks.

Unique rivet fasteners which seal themselves automatically against fluid or air leaks without caulking or sealing agents now are available in quantity.

The fluid-tight rivet attains its seal from a soft aluminum jacket or sleeve around its shank which extrudes or flows when the rivet is expanded during driving. A washer-head rivet is used where sealing is required under the head of the rivet only.—**Pastushin Aviation Corp., 5651 West Century Blvd., Los Angeles 45, Calif.** 252C

Aluminum Jacket

Deeply corrugated for tanks, towers and vessels.

A new deep-corrugated aluminum jacketing is designed for installation on tanks, towers and vessels. An integral moisture barrier, applied at the factory, completely eliminates corrosion of the jacket from within. Also, the barrier overcomes need for costly felt wrapping used formerly.

Deep corrugated jacketing is available with 1¼ or 2½-in. corrugation. Rigidity is increased by cross crimping the aluminum before adding the deep corrugations. Cross crimping increases strength up to 97% over plain corrugated aluminum.—**Childers Mfg. Co., Jacketing Sales Div., 3620 West 11th St., Houston, Tex.** 252D

Insulation Blanket

Resists temperatures up to 2,300 F. and keeps form and properties.

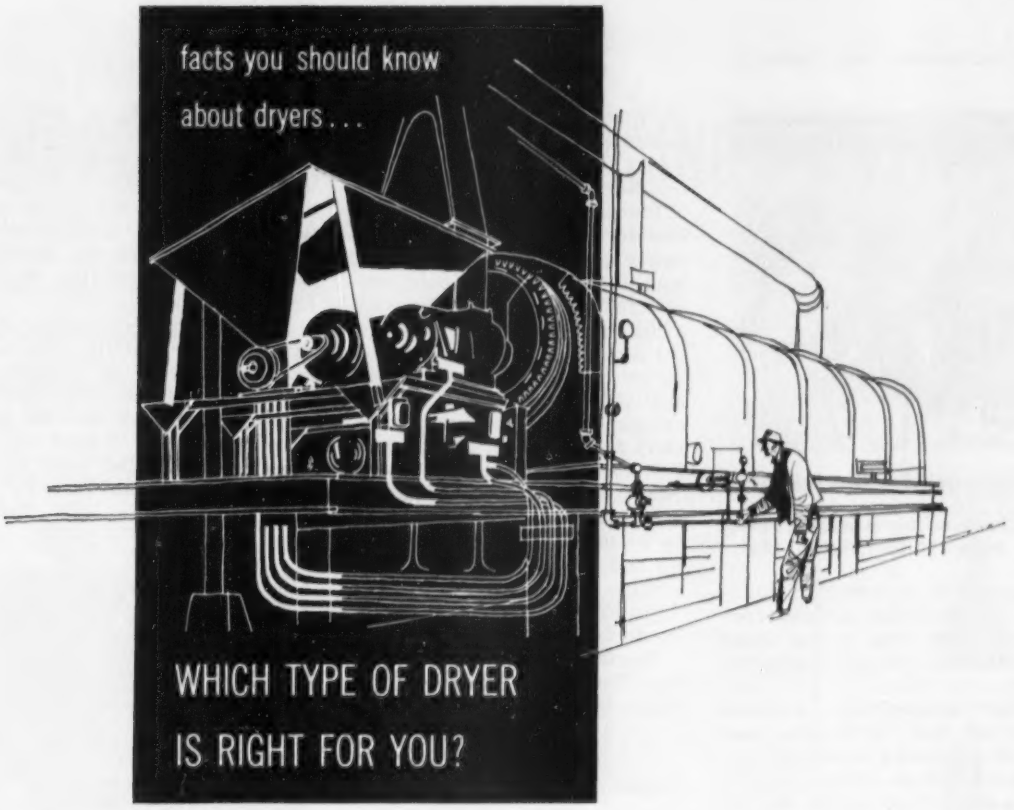
Formed from extremely fine, closely intertwined aluminum silicate fibers, the Fiberfrax ceramic blanket keeps its form and properties despite temperatures as high as 2,300 F.

Fiberfrax blankets may be used on high-pressure steam lines, diesel exhausts, gas turbines and furnace ducts. Possessing high chemical stability, the Fiberfrax blanket also may be used as insulation lining in alloy and refractory high temperature furnaces.

At 5 lb. per cu. ft. density, heat transmission in Btu./hr./sq. ft./°F/in. varies from 0.50 at 600 F. to 2.10 at 2,000 F.—**The Carborundum Co., Niagara Falls, N. Y.** 252E

Non-skid tread plate of aluminum has a fused aluminum oxide abrasive on one surface of the plate. Layer does not separate from plate during welding. Durable and corrosion-resistant, plate can be shop fabricated by most commercial methods.—**Aluminum Co. of America, Alcoa Bldg., Pittsburgh 19, Pa.** 252F

Gratings for stair treads, catwalks and platforms now available constructed of stainless steel for corrosive environments. Type 304 bar stock, 2-in. wide by ⅛-in. thick, is used—**Irving Subway Grating Co., Inc., Long Island City, N. Y.** 252G



For over 55 years, Louisville Dryers have been solving industry's drying problems and effecting marked economies. The following is intended as an introduction to selecting the right type of dryer.

Q. *What types of dryers are there?*

A. Many types. They can be classified in two basic categories, namely, batch type and continuous.

Q. *What is proper application of the continuous type?*

A. Where large enough capacity is required to make savings in labor, space, and fuel advantageous.

Q. *What are some other advantages of the continuous type?*

A. Uniform quality of dried product. Lower drying cost.

Q. *What types of continuous dryers are most used?*

A. Rotary, Conveyor, Flash, Spray, Atmospheric Drum.*

Q. *Do all of the above types handle the same kind of material?*

A. No. While they discharge a dried solid, Spray and Drum Dryers are fed with a liquid. (Liquids and thin slurries can be handled in the other types by means of special designs or auxiliary equipment, but seldom are).

Q. *How can I be sure of getting the right type of dryer for my operation?*

A. Louisville engineers start by surveying your needs. Then, after considering the pertinent factors, they make recommendations for dryer type, heating medium, etc. Their recommendations can be proved by practical drying tests in General American's pilot plant. Your Louisville Dryer is then designed and built to suit your particular purpose and to fit your individual needs.

Q. *How can I investigate the matter in greater detail?*

A. Call in a Louisville engineer. No cost or obligation.

*Discussions to follow will deal with the subject in more detail.

PROCESS EQUIPMENT DIVISION
GENERAL AMERICAN
TRADE MARK

LOUISVILLE DRYING MACHINERY UNIT

GENERAL AMERICAN TRANSPORTATION CORPORATION

Dryer General Sales Office: 139 So. Fourth Street, Louisville 2, Kentucky
Eastern Sales Office: 380 Madison Avenue, New York 17, New York
In Canada: Canadian Locomotive Company, Ltd., Kingston, Ontario, Canada
General Offices: 135 S. La Salle Street, Chicago 90, Illinois

Differential Flowmeter

Transmitter measures heads from 100 to 1,200 in. H_2O.

Low cost, accuracy, simplicity and flexibility are features of this new line of high-head differential pressure transmitters.

The transmitters measure rate of flow of liquids and gases producing maximum differentials from 100 to 1,200 in. of water. They utilize the accuracy of a mercury U-tube, available for maximum service pressures of 800, 3,500 and 6,000 psig. Also bellows are available for service pressures of 1,500 and 3,500 psig.

Since signals are linear with flow rate, measurements may be combined with other related factors on an evenly graduated chart. Receivers may indicate, record and integrate.—**Bailey Meter Company, 1050 Ivanhoe Rd., Cleveland 10, Ohio. 254A**

Flowmeter

Measuring element has no inherent pressure drop.

The new Nucor Magnaflow line of electromagnetic flowmeters converts liquid velocity directly into an electric potential without inherent pressure drop and with high accuracy.

Instantaneous and full-linear response make it ideal for control applications. You can measure flow rates as low as 100 cc. per min. and as high as 2,000 gpm.

The instrument is well adapted to the measurement of flow rates of highly corrosive liquids or radioactive solutions, of slurries and various suspensions.

For the great majority of liquids, the induced flow signal is independent of the electrical conductivity of the liquid. The measuring element is a smooth-bore Teflon tube with platinum electrodes and introduces no additional pressure drop into the line.

The Nucor Magnaflow is available in two types. Type A accommodates flow tube diameters from $\frac{1}{8}$ in. to $1\frac{1}{2}$ in.; type B accommodates diameters from $1\frac{1}{2}$ in. to 10 in. Standard units operate on pressures up to 1,000 psi. and special units up to 2,500 psi. and higher. Operating temperatures range from 350 F. for standard units, up to 500 F. for special units. —**Nuclear Corp. of America, Inc., Suite 4219, Empire State Bldg., New York 1, N. Y. 254B**

Sight Glasses

New sight glass windows are sealed directly to metal.

In new manufacturing process sight glasses are hermetically sealed to metal. Elimination of solder and gaskets overcomes the main weaknesses of sight glasses.

Windows which are tamper proof, unaffected by aging or vibration, and resistant to high pressures can now be made to your specifications. One design of $\frac{3}{4}$-in. diameter and $\frac{1}{4}$-in. thick withstands pressures greater than 5,000 psi. Another, of $\frac{3}{4}$-in. diameter and $\frac{1}{8}$-in. thick operates at 2,000 psi.

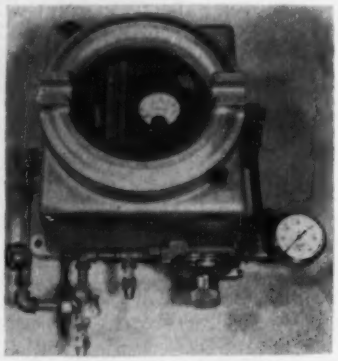
The windows can be mounted in almost all ferrous and nonferrous metals including brass and stainless steel.—**Corning Glass Works, Corning, N. Y. 254C**

Thickness Gage

Null-balance operation provides continuous standardization.

A sealed "source" emitting beta rays measures thicknesses to close limits in this new instrument which gives you mass per unit area. It is used to measure and control sheet thickness, basis weight, coatings and is particularly adapted to measurements which cannot be made with conventional equipment because the instrument does not touch the measured materials.

Null balance operation insures greater stability and accuracy as well as providing two means of continuous standardization. Scales can be set up to read in any desired units. —**Isotope Products, Inc., 1700 Niagara St., Buffalo 7, N. Y. 254D**



Selective Gas Analyzer

Is specific for one gas in a multi-component mixture.

This new instrument has emerged from the experimental stage. Concentration of one gas in a multi-component mixture can now be measured more specifically without sample conditioning procedures.

Filaments of four detector cells, instead of the usual two, maximize the effects of the gas to be measured. Different types of filaments may be used in the cells to further maximize these effects.

A heat-loss equation, expressing convection and conduction is used as a guide to enhance the effects of one gas on one arm of the bridge while making equal the effects of the background gases on both arms. The relative influence of each factor is determined empirically.

Reproducible results can be obtained within approximately 2% of full-scale reading.

The instrument has been ap-

This advanced-type equipment is making

MORE PROFITS FOR PROCESSING INDUSTRIES

The principles of attrition-grinding and impeller-dispersing as embodied in the new models of Morehouse Mills and Cowles Dissolvers are producing spectacular results in over 70 industries throughout the world. They can do the same for you.

LET US PROVE IT IN YOUR PLANT — AT OUR RISK!

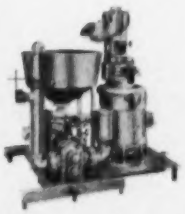
TYPICAL MOREHOUSE MILLS

Many models to choose from — capacities from 1 to 2000 gals. pr. hr.

MODEL B-2000. Height, 66⅝"; width, 31⅝".

MODEL M. Height, 38⅝"; diameter, 14".

MODEL 88-30. Height, 50"; diameter, 20".



MODEL B-2005 Grease Mill and Deaerator. Height, 72"; width, 28".

If you process products like these —

ADHESIVES	FILTER CAKE
FUNGICIDE	COATINGS
PAINTS	ENAMELS
SODIUM DISPERSIONS	SOLIDS CONCENTRATIONS
STARCH COOKING	GAS DISPERSIONS
PLASTISOLS & ORGANISOLS	PLASTER DISPERSIONS
POLYESTER RESINS	INKS

... there is a Morehouse or Cowles unit to meet your needs — in stainless steel where required.

Morehouse attrition-grinding mills reduce particle size by processing the material between a stator and a rotor that operates at ultra-high speed — up to 5400 R.P.M. As a result amazing volume is produced in a fraction of the space required by ordinary equipment. Micro-adjustment assures accurate control and duplication of desired particle size with consequent improvement in appearance, texture and overall quality. Operation is smooth, practically vibrationless, and trouble-free

Cowles impeller-dispersing dissolvers easily handle viscosities in excess of 50,000 centipoises. Patented impellers rotate at peripheral speeds of 2000 to more than 5000 F.P.M., producing great shear, impact and turbulence. Volume is increased many-fold over old style mixers. Ultimate dispersion is achieved in a fraction of the time. Quality improvement is immediately apparent.

A trial will convince you that you too can **Make more profits with Morehouse and Cowles.**

Arrange for such a demonstration in your plant, *at our risk.* Write today for complete details.

MOREHOUSE-COWLES, INC., 1150 San Fernando Rd., Los Angeles 65, Calif. Representatives in Principal Cities (Cable Address "MORESPEED," Los Angeles).

Quality Production Champions of the Processing Industries

Convenient lease and time-payment plans.

MOREHOUSE COWLES

TYPICAL COWLES DISSOLVERS

Many models to choose from

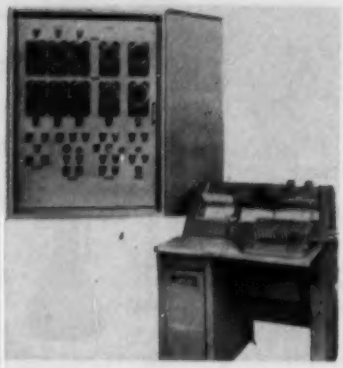
10 AND 20V with hydraulic lift. For big-volume production. 80" high, 10-40 HP.

10 AND 20D, for installation on your own tanks. For adaptation up to 40 HP.

7-VTV. Mobile Tip-Up Type. For 5 to 80 gallon batches. Max. tilt will accommodate 46" tank.

1-VG Laboratory Lift-Up Type. For testing, pilot plants and small batches. Results identical to production-size models. Max. rise, 10".

plied to a variety of gas analysis problems, and is being used in problems in which gas mixtures contain as many as seven components.—**Mine Safety Appliance Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.** 254E



Proportioning System

Keeps its own accounting records of weighings.

This new fully automatic electronically controlled proportioning system automatically records formulas and weighings on a summary punch card by means of a recording device interlocked with the action of the panel.

This new feature permits you to process billings, maintain inventory control and keep records of weighing and proportioning by processing punched cards through an IBM business machine.

The system is designed for either full-automatic or semi-automatic operation. In full-automatic operation, you set up a formula on the panel's control dials and set the system to repeat the formula as many times as desired. For semi-automatic operation, you set the controls each time a formula is fed into the system.—**Richardson Scale Co., Van Houten Ave., Clifton, N. J.** 256A

Vacuum Gage

Design has voltage regulator, temperature-compensated thermopile.

Half scale on the dial face of this gage is 15 microns, providing excellent readability for low micron measurements. The instrument is highly accurate throughout the entire range of measurement.

Improved design of the gage tube, incorporating a temperature-compensated noble-metal thermopile, gives greater sensitivity and accuracy in the low micron range. A nickel-plated gage tube houses the thermopile, preventing outgassing, system contamination and corrosion. The gage tube need not be removed to clean the vacuum system.

The instrument operates on 115 v. a.c. and includes an internal voltage regulator to smooth out line voltage variations.

Dimensions of the instrument case are 5¼ x 5¾ x 7⅛ in. and it is also available for panel mounting. — **Hastings-Raydist, Inc., Hampton, Va.** 256B

Pocket pH Meter

For on-the-spot readings, is reflex-camera size.

A pH meter, now available, comes complete with batteries in a plastic case that measures 3 x 5¾ x 2¼ in. Outer waterproof carrying case with shoulder strap also contains novel plastic tubes of KCl buffer solution.

Meter has accuracy of 0.1 pH. Hearing-aid batteries provide up to 1,300 hr. operation.—**Analytical Measurements, Inc., 585 Main St., Chatham, N. J.** 256C

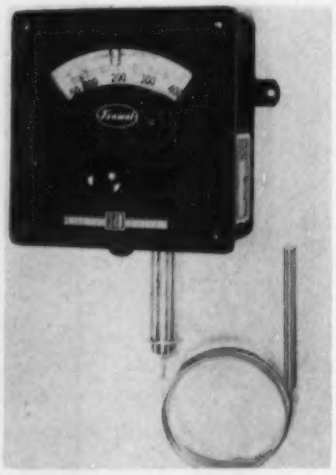
Load Cell

Unique design gives off-center loading stability.

Off-center loading stability is the big feature in a new load cell marketed specifically for bin, tank and hopper weighing systems.

A unique design called "rolling ball" construction provides all-important off-center loading stability. A hardened steel ball located beneath the loading platform of the cell between two hardened steel inserts not only permits the tank or bin to expand laterally, but transmits the force to the cell so there are no inaccuracies. The self-leveling ball also allows platform surface to tip without exerting undesirable loading on the cell.

Force on the cell-loading platform is transduced into hydraulic pressure which actuates an indicator, recorder or controlling device in automatic bin and tank weighing installations.—**The A. H. Emery Company, Pine St., New Canaan, Conn.** 256D



Temperature Controller

Wide choice of elements; can be tailored to given application.

This new bulb-and-capillary indicating temperature controller features a wide choice of interchangeable elements which permits you to tailor the control to the application.

The new controller, accurate within 2 deg. F. under optimum conditions, is rugged, easy to read and convenient to adjust and service in the field.

Two control switches, with a temperature setting pointer for each switch, permit two independent circuits to be operated by the same instrument at any two selected temperatures.

The controller is case-compensated for ambient temperatures between 50 and 100 F. and is dust proof and splash proof.—**Fenwal Inc., Ashland, Mass.** 256E

AN ADAMS *Report*

• Filtration the Answer to High Costs of Industrial and Process Water

Part 1

The continued expansion of our free economy is forcing management and design engineers to face the problem of *water*. Water is as essential to industrial development as it is to human life.

Municipal Supplies Limited

More and more we read stories in the daily papers of various cities which have had to apply restrictions on water consumption. While sprinkling bans may ruin your lawn this year, it is an omen of a possible water shortage in the future.

Natural Resources Restricted

The use of natural water resources . . . lakes and rivers . . . is being restricted by pollution. For example, the entire water of one of the major eastern rivers is reused seven times while moving one mile down stream. To make use of this water for industrial purposes involves an extensive treatment system . . . resulting in a high initial capital expenditure.

Water the Life Blood of Industry

This is not a patent cliche! It is a basic fact. Years ago water's primary importance to industry was as a means of transportation. Today water is essential to industrial survival. As with any commodity, as the supply decreases with respect to demand, the price per unit increases.

The cost of industrial and process water has risen rapidly during the past 10 years . . . will rise even further and more rapidly during the coming 10 years.

Methods of Solving Problem

More and more firms consider the problem of water shortage when planning the location of new plants. Plant sites are chosen near natural water resources. When the source is a river or lake, their planning often includes waste water disposal . . . a factor that did not exist some years ago.

River and lake water, particularly during rainy season run-offs, require water treatment of some sort. The higher the quality of the water needed by the plant, the more expensive the water treatment . . . but in the long run it pays for itself.

Filtration of the raw water with an Adams AWF Automatic Filter can eliminate the need for a pre-treatment settling basin. If water softening equipment is used, the AWF may also help reduce the cost of this equipment by removal of heavy sludge.

Filtration After Treatment

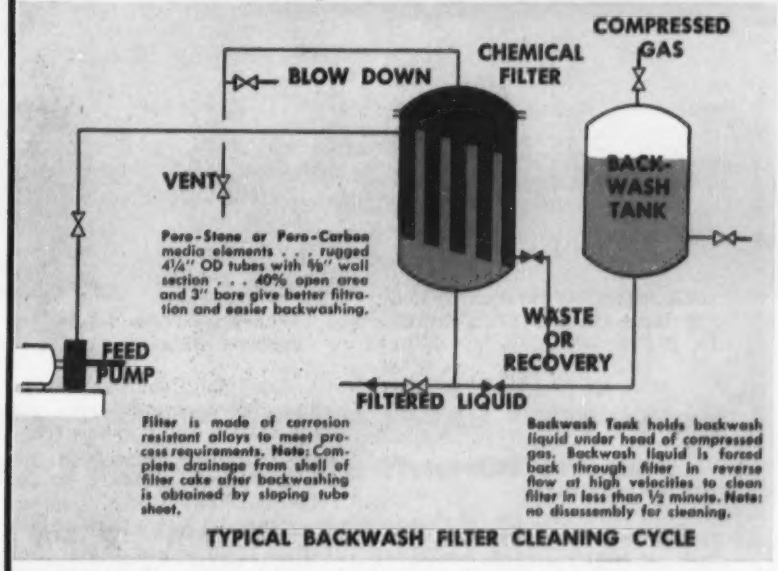
Where the polish of the industrial or process water is a critical factor, it very often pays to install a filter after the softening equipment. In this application the filter acts to remove the precipitated salts. These salts cause trouble by collecting in low spots, or reacting chemically when introduced into process solution. This phase of keeping your industrial water costs down will be covered in the next *Adams Report*. Watch for it.

New Bulletin Available

Bulletin 909, on the Adams AWF Automatic Filter is available upon request from the R. P. Adams Company, Inc., 207 East Park Drive, Buffalo 17, New York.

ADAMS BACKWASH DESIGN

can lower your filter labor costs...


COMPRESSED GAS
CHEMICAL FILTER
BLOW DOWN
VENT
BACK-WASH TANK
Pero-Stone or Pero-Carbon media elements . . . rugged 4¼" OD tubes with ⅝" wall section . . . 40% open area and 3" bore give better filtration and easier backwashing.
WASTE OR RECOVERY
FEED PUMP
FILTERED LIQUID
Filter is made of corrosion resistant alloys to meet process requirements. Note: Complete drainage from shell of filter cake after backwashing is obtained by sloping tube sheet.
Backwash Tank holds backwash liquid under head of compressed gas. Backwash liquid is forced back through filter in reverse flow at high velocities to clean filter in less than ½ minute. Note: no disassembly for cleaning.

TYPICAL BACKWASH FILTER CLEANING CYCLE

There are numerous filters which will meet the needs of your particular process. Your problem has become . . . "Which one shall I buy?"

Doubtlessly, there are other units which will produce as clear an effluent as the Adams filters. So the choice would seem to narrow down to initial investment. Here you will find Adams filters competitive in price.

What about operating and maintenance costs? That's where the Adams filter can save you money!

You clean your Adams filter by operating a few valves . . . no time consuming and often dangerous manual disassembly and cleaning necessary. Your filter is off-stream for as little as two minutes and seldom over 15. The liquid required for cleaning is only a small fraction of that needed by other filters using the reverse flow technique. And what's more, you get thorough cleaning. The Backwash liquid is easily recovered if necessary.

R. P. ADAMS CO., INC.
207 E. PARK DRIVE
BUFFALO 17, N. Y.

R. P. ADAMS COMPANY, INC.
207 East Park Drive
Buffalo 17, N. Y.

Gentlemen:

We have a problem in chemical filtration. Please send us your Bulletin 431.

Name.....Title.....

Firm.....

City.....State.....

Drum Rack

Drains drums quickly, easily and safely.

With the new Revere dispensing rack one man can put drum on rack, roll it to the proper location, then adjust the drum to the proper height by cranking.

Drum is simply tilted onto rack which permits storage on end until the drum is ready for use. Then, operator turns a crank in front to raise the drum to the dispensing position required.

Rack is mounted on four steel casters for greater mobility.—**Standard Safety Equipment Co., 232 West Ontario St., Chicago 10, Ill. 258A**

Rupture Disk

Designed for severe service conditions.

A new type of rupture disk now available brings safety-head protection to installations where conditions of pressure, temperature and corrosion are too severe for conventional type disks.

Model D rupture disk has two matched, pre-bulged disks assembled as a unit for installation in a safety head. The upper disk is slotted; the lower, similar to a conventional disk, provides the pressure seal.

The lower or sealing disk, of either metal or plastic, isolates the top disk from the system. Rupture pressure is unaffected so long as this disk remains impervious to the vessel contents.

Model DV disks contain a third element which supports the sealing disk for service on intermittent or continuous vacuum.—**Black Sivalls & Bryson, Inc., 7500 East Twelfth St., Kansas City 26, Mo. 258B**

Nylon Tubing

Large diameter, thin wall for chemical use.

Efficient liquid handling coupled with low-cost installation and maintenance characterize a new line of large diameter, thin-wall nylon tubing.

Tubing has good chemical resistance and high burst strength. It can be held to close tolerance and is joined together easily to custom fit job requirements.

Nylon tubing is insoluble in common solvents, alkalis, dilute mineral acids and most organic acids. Petroleum oils and greases at temperatures up to 300 F. have no effect on the tubing.—**Keystone Plastics Co., Inc., Union, N. J. 258C**

Oxygen Pump

Transfers from liquid to gaseous state.

A new pump and vaporizer pumps oxygen, nitrogen or argon from a liquid at low temperature and pressure to a gas at any desired pressure up to 5,000 psi. The pump can be manufactured in a range of capacities from 250 to 30,000 cfh. It can be operated from a liquid storage tank or direct-connected to a liquefier.

Pump is driven by electric power. Heat for vaporizing may be supplied by electricity or steam.—**Superior Air Products Co., 132 Malvern St., Newark, N. J. 258D**

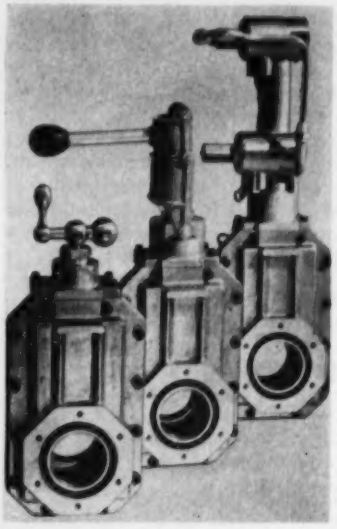
Axial Fans

Constructed entirely of plastic for fume service.

Problems of maintenance due to chipped or worn coatings are eliminated with a new line of industrial axial fans constructed from solid plastic. Constructed of either Rigivin rigid vinyl or Rigidon glass-reinforced plastic, these fans are suitable for a wide range of corrosive services.

All units are V-belt driven and designed with corrosion-resistant seal, slinger ring, external grease fittings and externally vented bearing housing. Designed for either horizontal or vertical mounting, all that the fan requires for mounting in a duct system is a single support attached to the motor base bolts.

Sizes available are 18, 24, 30 and 36 in. for 2,000 cfm. and upward.—**Heil Process Equipment Corp., 12901 Elmwood Ave., Cleveland 11, Ohio. 258E**



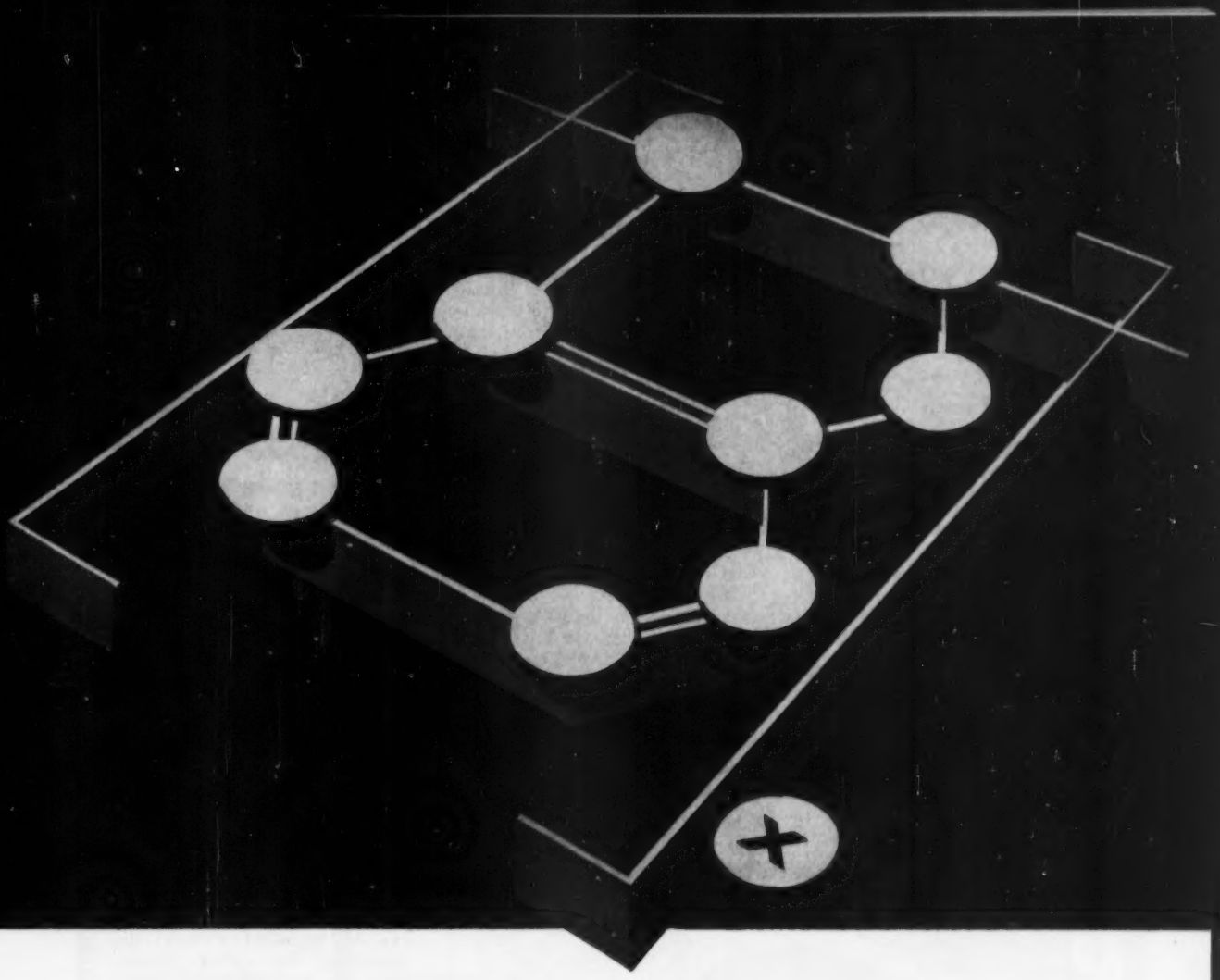
Vacuum Gate Valves

Full opening with short flow path.

Three new types of high-vacuum, straight-through gate valves have been announced recently. Valves will seal vacuum-tight in either direction.

In all of the types and sizes, the valve plate is connected to a follower carriage through two hinged links and is guided by rollers in opening and closing. The sliding motion of this mechanism prevents any scuffing of the plate gasket.

Actuation for the valves is either throttling manual, quick-



Neville Coumarone-Indene Resins Have Improved Many Products—Yours Could Be One Of Them

In the manufacture of many products from paints to rubber tires and floor tile to chewing gum, Neville resins have long proved their ability to help make better looking, longer wearing, more salable merchandise. Neville produces an extremely wide range of coumarone-indene resins under the most exacting of specifications, and conducts broad and constant research on their mutually profitable use in many types of products. If you have an item which is conceivably applicable, we suggest you send for further information. Without obligation, our chemists will work with yours in developing the application and selecting the proper grade for the job. Use the coupon below.

Neville Chemical Company • Pittsburgh 25, Pa.

Resins—Coumarone-Indene, Heat Reactive, Phenol Modified Coumarone-Indene, Petroleum, Alkylated Phenol • **Oils**—Shingle Stain, Neutral, Plasticizing, Rubber Reclaiming • **Solvents**—2-50 W Hi-Flash, Wire Enamel Thinners.

NEVILLE

Please send further information on Neville Chemicals.

NAME TITLE

COMPANY

ADDRESS

CITY STATE

acting manual or pneumatic. Made with aluminum body and valve plate, and steel working parts, the valve comes in 2-, 4- and 6-in. dia.—**Consolidated Electrodynamics Corp., Rochester Div., 1175 Mt. Read Blvd., Rochester 3, N. Y.** 258F

Process Pump

Emphasizes complete interchangeability of components to cut inventory.

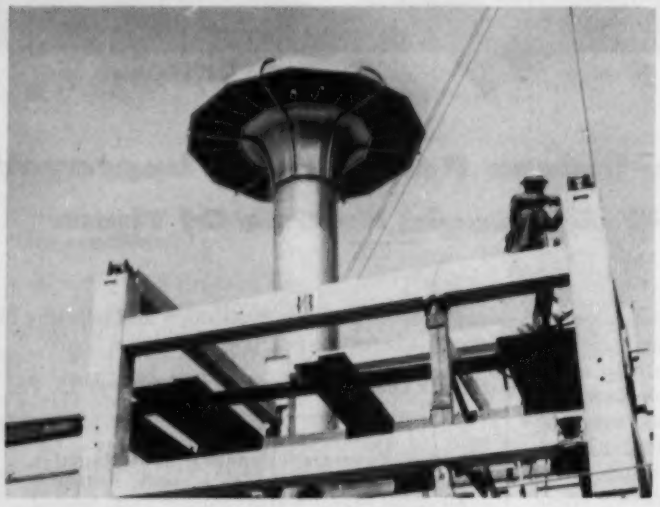
Through complete interchangeability of components the new DL and DM process pumps are expected to cut replacement part inventories up to 85%. Other benefits are greater application versatility and the ability always to have the most efficient pump for every liquid condition.

To either the Type DL (grease lubricated) or Type DM (oil lubricated) the user simply adds the desired back plate, impeller and volute to build the pump needed for a given service. The 8¼-in. frame will accommodate four liquid end sizes, 1- through 3-in. discharge. On the 10½-in. frame can be handled five sizes, 1- through 4-in. discharge.

Driver can be standard electric motor on pump base.

Back plates are either air or water cooled. There is choice of open impeller with repelling vanes or enclosed with balance chamber. The oil-lubricated bearing housing can be water cooled.

With the available combinations, user can handle capacities up to 800 gpm. against heads up to 400 ft. Units can be furnished in any machinable metal.—**Peerless Pump Div., Food Machinery & Chemical Corp., 301 West Ave. 26, Los Angeles 31, Calif.** 260A



Snorkel Feeds Air to New Fluid Coker

Rising 70 ft. above grade, this intake hood feeds air to the blowers on a fluid coker at the Avon Flying A refinery of Tidewater Oil Co., Associated, Calif. The hood is a twelve-sided polygon, 21 ft. across and 12 ft. high; suction line is 5½ ft. dia. A 1-in. layer of Fiberglas lines the hood and line to deaden the noise of 45,000 lb. per hr. of air entering the opening.—Bechtel Corp., 220 Bush St., San Francisco 4, Calif. 260B

For More Information...

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

Loading Arm

Spring balanced for easy operation and simple replacement of seals.

New type 890 loading arms are engineered expressly for the chemical and process industries. They are available for any liquid handling service in a range of construction materials.

Positive operation, full flow and long service life are assured by design features that include spring balancing, internal streamlining and hard surfacing of all ball races.

Spring-balanced arm remains in fixed position during loading, regains upright position by spring action. Packing seal can be replaced without dismantling the swing joint.—**Wheaton Brass Works, Union, N. J.** 260C

Turbine Pump

For light liquids at low suction head.

A new series of turbine, single and double stage process pumps handles liquified petroleum gases, refrigerants and other light non-viscous liquids. Pumps operate at low suction head requirements assuring a positive, non-pulsating discharge flow.

There is no shaft leakage because built-in pressure relief keeps pressure against the mechanical seal at a minimum. Balance holes on both sides of the impeller equalize pressures in single-stage pumps. On two-stage units, impeller loads are balanced radially by opposing pressures between stages.—**The New York Air Brake Co., Aurora Pump Div., 192 Loucks St., Aurora, Ill.** 260D

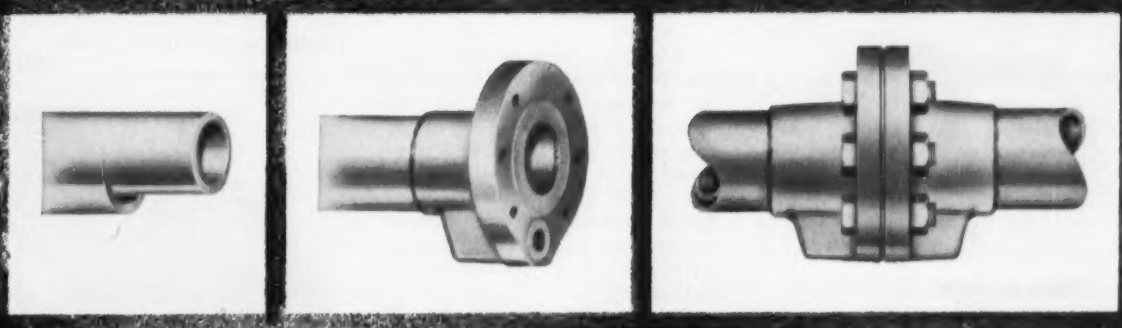
Completing the new concept in steam-traced pipe . . .

NEW ALCOA FLANGE

Makes joining UNITRACE sections as simple as 1, 2, 3

ALCOA created UNITRACE®, a new concept in steam-traced pipe . . . steam and product passages extruded in a single unit of corrosion-resistant ALCOA® Aluminum. The new UNITRACE flange, cast in ALCOA Aluminum alloy A356-T6, adds simple, efficient joining to that concept. Both steam and product passages are cast as integral parts of the flange, thereby eliminating product "freezing" at the joints.

With UNITRACE and the new UNITRACE flange, you can save up to 30% on labor while cutting material and insulation costs. Get the full story today! Write for new illustrated booklet, *Alcoa Unitrace*. Address: Aluminum Company of America, 903-K Alcoa Building, Pittsburgh 19, Pennsylvania.



With this new Alcoa flange, three simple steps create efficient UNITRACE joints: (1) Cut back trace lines 1¾" from the ends of sections to be joined, (2) Slip flanges into place and weld their front faces and necks to the sections with 4043 weld wire, and (3) Bolt flanges together.

Two separate gaskets seal product and steam passages between mating flanges. Bolt holes mate with standard 150-pound, 2-inch ASA pipe flanges and fittings for easy joining to other piping and equipment.

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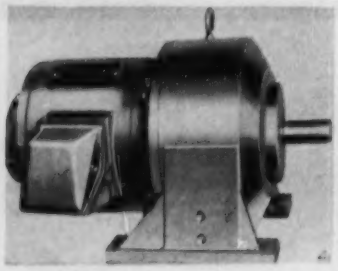
Electrical Tape

Vinyl compound resists difficult environments.

A complete line of vinyl electrical tape in 8- and 10-mil. thicknesses now is available carrying the Underwriters' Seal of Approval. It is recommended in place of friction and rubber tape where abrasion exists or where tape is exposed to water, acids, alkalis or other corrosive conditions. Also, it is neater and more efficient, it is said.

This tape is tested to 10,000 dielectric volts. Therefore, it requires much less wrapping than friction and rubber.

Initially, it is more expensive than friction or rubber tapes. But its longer-lasting qualities, both in use and in the amount needed to complete a splice, make it much more economical. —**Quaker Rubber Div., H. K. Porter Co., Inc., Philadelphia 24, Pa.** 262A



Gearmotor

Utilizes latest advances to assure long trouble-free service.

The latest design principles of mechanical gearing and electric motor development are incorporated into a new line of a.c. and d.c. gearmotors. Long, trouble-free service is assured under adverse operating conditions.

Two-way seals lock oil in and seal dirt out so that the gearmotors may be mounted in virtually any position without oil leakage. Extremely hard surfaces on the teeth of the tough alloy-steel gears make for strength and wear resistance. Simple gear train has fewer parts to wear, less mechanical friction and transmits power better, it is said.

Available from 1 to 60 hp., gearmotors have a wide selection of mountings, enclosures and ratios.—**Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio.** 262B

Electrical Connector

Joins copper to aluminum, withstands severe natural environments.

This new copper-to-aluminum electrical connector is reported to perform satisfactorily in areas where other available connectors have failed in a relatively short time. It eliminates the two principal problems faced when two dissimilar metals are joined: galvanic corrosion and thermo-elastic ratcheting.

The ALCUnector consists of a deep aluminum cup and one of copper which are butt-welded together at the closed ends, then sealed hermetically in a rubber ball and cement system.

The ALCUnector lends itself to almost any method required for attaching conductors and terminations. Normally it is attached by the compression barrel method. However, a combination of compression barrel and split-bolt connectors also has proved satisfactory. A number of ALCUnectors have been produced in open tip and in large size conductor-to-terminal designs.—**Kaiser Aluminum & Chemical Corp., 1924 Broadway, Oakland 12, Calif.** 262C

Slip-Type Drive

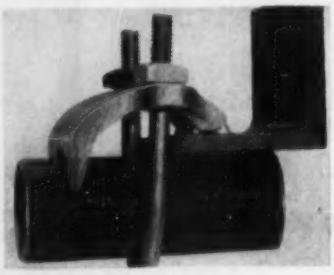
Uses magnetic force for smooth pickup.

Completion of licensing agreements brings the Whitney-Tormag magnetic drive to the U. S. market. Prototypes in various horsepower ranges now are being placed in various test areas to evaluate present design characteristics. Units will be generally available within the near future.

The Whitney-Tormag drive provides a flexible slip-type drive between a motor and its load, in a range from fractional horsepower to over 50 hp.

Drive consists of a magnetic rotor which carries strong Alnico V permanent magnets; and a bimetallic rotor which is a copper-faced, mild steel plate or cylinder.

The rotors are mounted face-to-face with an air space between them. If either of the rotors is driven, a torque is induced in the other through eddy currents, with the permanent magnets supplying the necessary magnetic flux.—**Whitney Chain Co., Hartford, Conn.** 262D

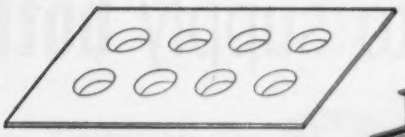


Pipe Clamp

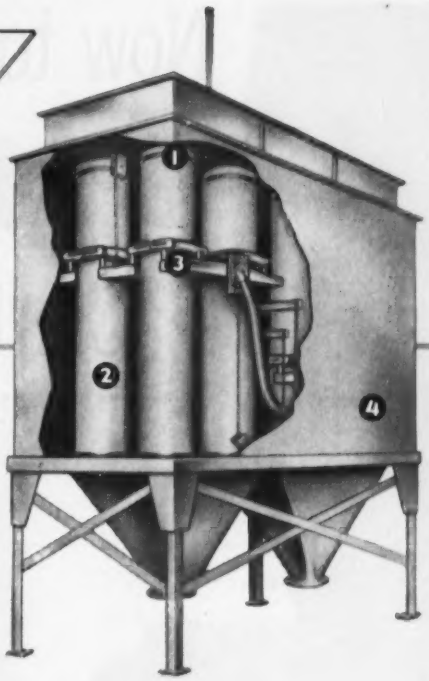
Attaches pipe or conduit to steel frame.

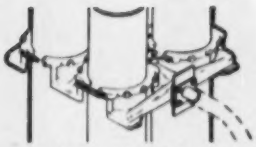
The New Latrobe clamp attaches pipe or conduit to steel frame work without need for drilling holes. Made of high quality malleable iron and cadmium plated to prevent rust, the Latrobe clamp has a double bite of case-hardened tool steel.

Clamp is made in two models: one for right-angle support and one for parallel support. Ten sizes range from ½ to 4 in.—**Fullman Mfg. Co., 1211 Jefferson St., Latrobe, Pa.** 262E

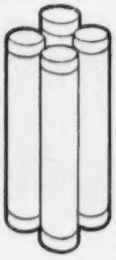


1 Air enters plenum casing at top of Series 12 Aeroturn for equal distribution to all filter bags. Bags are of felt . . . with higher filtering efficiency than woven material. Tiny pores hold even submicronsized dust particles. Cloth area is less than ⅛ that of shaker bags.

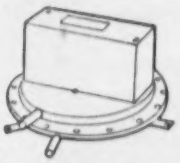




3 Self-adjusting blow rings* travel length of filter bag exterior . . . discharge reverse-air-jet into bag which blows accumulated dust off bag walls. Cleaning never interferes with filtering . . . which maintains peak efficiency. Aeroturn remains on the job continuously.

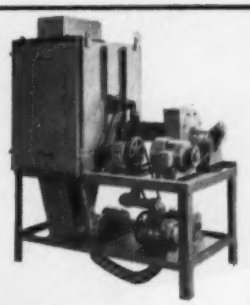


2 The air travels downward through the filter bags, assists delivery of dust into hoppers below . . . escapes through bag walls. Even distribution of dust puts every square inch of the filtering surface to work . . . avoids clogging . . . permits air to escape easily.



4 Automatic pressure switch* controls blow ring operation. Above normal pressure loss automatically actuates blow rings. When pressure loss normalizes, blow rings stop operation. Self-cleaning occurs as often or as little as needed . . . avoids over-cleaning.

Up to 75% Lower Installation Costs—99.9%+ Efficiency with KOPPERS Series 12 Aeroturn Dust Collectors!



Factory-assembled and test-operated, Koppers Model D Aeroturn Dust Collector combines features of Series 12 with unusual compactness. Capacities range from 500 to 4,800 CFM.

50% Lower Maintenance Costs . . . Up to 50% Less Space!

Aeroturn's remarkably high filtering efficiency slashes your plant and machinery maintenance costs further than can any other dust collector. Heating and cooling costs tumble because air can be recirculated . . . cleaner than outside air. Employee and community relations are improved. Yet Koppers Series 12 Aeroturn costs you less to install . . . less to maintain. Space requirements are far smaller.

Operation is continuous and automatic . . . without a drop in peak efficiency due to cleaning. Pre-fabricated Koppers Series 12 Aeroturn ranges in capacity from 1,000 to 60,000 CFM . . . contains from 4 to 64 filter bags each 12″ in diameter and up to 18′ in length.

It takes only a few minutes of your time to discover how Koppers Series 12 Aeroturn may save you thousands of dollars.

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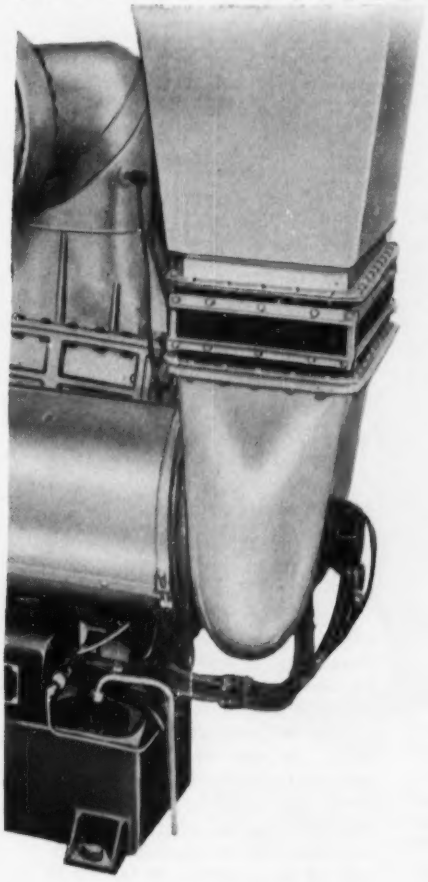
Quick shutdown–instantaneous–no turning gear
Field proved–forty units delivered
Light weight–less than 6 tons
Compact–only 16′ long, portable
Long life–conservative blade temperatures
Air cooled–long life–cool outer surface
Packaged–shipped assembled, ready to install
Fuel versatility–liquid or gaseous
Installation flexibility—up or down duct connections
Variable speed–physically separated turbines
Single combustion chamber—lasts a lifetime

and **Steam**

the **Mark TA** Gas Turbine



Power to drive a generator, pump or centrifugal compressor and low or high pressure steam for process use . . . the new Clark Mark TA 1130 bhp gas turbine will do both when equipped with a waste heat boiler. In addition to the 1130 bhp of rotative energy the turbine-boiler package will deliver 9500 lbs. of steam per hour at a combined fuel utilization of up to 79%. It's the most modern, compact and efficient power plant combination you can install!

The new turbine is also well suited to driving rotative loads without a waste heat recovery system. Its light weight, compactness and quiet, practically vibrationless operation makes it ideal for marine or portable use as well as for permanent installation.

Your nearest Clark representative will be pleased to give you all the facts about Clark gas turbines in sizes to 8500 bhp, or write for bulletin 142.

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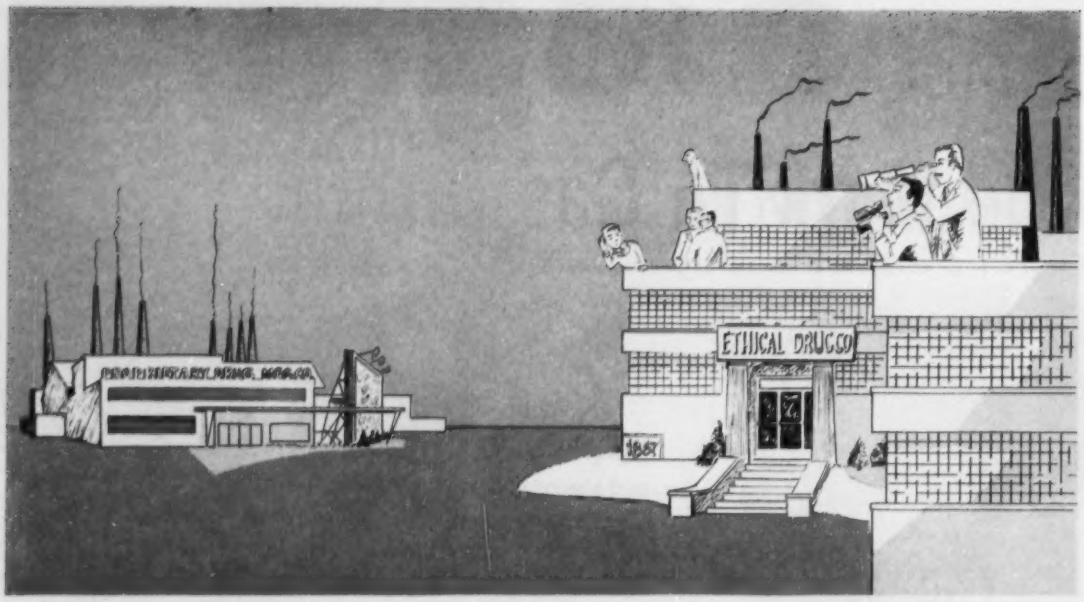

Consumer Trade Lures Ethical Drug Makers

Proprietary firms are already in the ethical drug business. Ethical firms may move to reciprocate. It's hardly a trend yet, but much more than a rumor.

The past few years have seen many firms move way outside their accustomed business orbits, and with considerable profit, too. They call it diversification and it makes for some strange bedfellows.

Yet you couldn't imagine a more unlikely pair than an ethical drug manufacturer with a line of products marketed in a proprietary manner.*

But, to rephrase a phrase, "It can happen here." Many say it can't, at least not on any significant scale. Maybe they're right. But this is a certainty: Today the mass consumer market is beckoning to ethical drug manufacturers as never before. And although there are still the same compelling arguments against such a change in basic policy, the lure may prove irresistible.

▶**Calculated Risk** — Take Charles Pfizer's recent step, for instance. This prominent chemical firm with an ethical pharmaceutical bent has moved aggressively before. But no earlier move has ever been more provocative or watched with such bated breath (by Pfizer as much as by its fellow ethical drug makers, we suspect) as its young campaign to promote Bonamine, an ethically-proven motion sickness drug, to the consumer via TV, press and radio—in the form of flavored tablets called Bonadettes, packaged, significantly, under the Pfizer label.

Pfizer spokesmen put it this way: Aided by this promotion, Bonamine is now achieving the market which our sales people estimated it should command."

This is a very revealing statement. It says that an ethical drug manufacturer, disappointed with the sales of a product through ethical promotion, but convinced of the quality and appeal of the product, is taking it to the public for a verdict.

The verdict on Bonadettes must be gratifying to date, for Pfizer now plans a similar program for Candettes, throat lozenges which contain the antibiotics, bacitracin and polymixin. The company admits, too, to be planning the acquisition and/or formation of a proprietary arm.

▶**A Little Mixing**—You've got to search to find any other ethical drug company program to match this, although there are evidences here and there of ethical drug company activity in pro-

* Let's get our definitions straight before we go any further. The words "ethical" and "proprietary" denote the manner in which the manufacturer promotes his product. An ethical drug is advertised only to the medical profession and drug trade (regardless of whether it is available by prescription only). A proprietary drug is promoted via the popular media to the direct consumer, the public. Thus an ethical drug may be freely available "over-the-counter" to all.

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UNUSUAL DESIGN for a chemical manufacturer. Note angle of ends of the 839 copper tubes. Fixed and floating heads are aluminum bronze. Photo from Camden Copper Works, Camden, N.J.

TWO COPPER mixers, used for coating and blending powder. Made by Camden Copper Works, including the rotating mechanism.

These two pictures show the versatility of Revere Copper. One, made for a chemical company, contains 839 copper tubes, and an unusual feature of the design is that the ends are cut at an angle. The fixed and floating heads are aluminum bronze. The other photograph shows two copper mixers, which rotate and are used for blending and coating powder. They are much like equipment employed in making coated candies.

These are examples of the special adaptability of copper. Both items were fabricated by the Camden Copper Works, Camden, N.J., which manufactures equipment to individual designs. Like Revere, it offers technical collaboration. It is an important Revere customer.

Remember, the copper shortage is over. Revere Copper is freely available now in plate, sheet, strip; rod and bar; tube and pipe; extruded shapes; forgings; lockseam tube and rolled mouldings. See the nearest Revere Sales Office. Write for free booklet, "Life Extension for Condenser Tubes."

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Proprietary Drug Firms Move Into Ethicals

A decided shift of ethical drug manufacturers into the proprietary trade would finish rubbing out most of the distinction between the two branches of the drug industry.

Actually the line between the two has been fading over the years. Most of the "mixing" has resulted from proprietary drug houses moving into ethical pharmaceuticals either through acquisition or internal reorganization.

Back in the forties Vick Chemical took over William S. Merrell, an ethical drug house; American Home Products assumed control of Ayerst Lab and Wyeths Labs; Miles Labs acquired Ames Co.; and Bristol-Myers set up Bristol Laboratories.

Warner Lambert Pharmaceutical, a proprietary drug maker, took over Chilcott Labs in 1952 and Harrower Labs in '55. Carter Products merged with Wallace Labs (ethical drugs) in 1953, Rexall Drug set up Riker Labs in 1952 as its ethical arm and Norwich Pharmacal established the Eaton Labs division in 1954. Vick Chemical acquired National Drug this year.

There are plenty of good reasons for this happening and for it to continue:

- **Obviously the proprietary people were attracted by the profit potential manifest in the ethical drug business, a business whose total sales at the manufacturing level soared from about $300 million to more than a $1.2 billion in 15 years.**
- **The proprietary people were also dismayed at the replacement of patent medicines by powerful specifics prescribed by the medical profession. They were anxious to maintain their national prestige in the era of the wonder drugs.**
- **Research by 100% proprietary drug makers must necessarily be limited to products that can be safely marketed over the counter. But stepped-up modern research has doubtless suggested to them more and more products which, although unsuitable for proprietary promotion, could make money as ethical items.**
- **Proprietary drug makers seek to round out their portfolio of products with some that offer a good margin (albeit often a modest volume) without staggering advertising costs. Ethical drug products tend to sell on the basis of genuine newness and/or uniqueness. Competitive proprietary drugs are often identical chemicals with different faces.**

In one sense, a proprietary product is never really "sold" to the public. It must be hammered home again and again—and this costs money. Once a doctor is sold on the utility of an ethical drug he generally sticks with it.

That ethical drug makers should now feel the urge to go proprietary shows how sound that old adage really is about putting your eggs in one basket.

prietary fields—much of it of a more subtle nature.

Abbott Labs. is now running a consumer campaign for Sucaryl, its synthetic, non-caloric sweetener which has been widely used for some time in dietetic foods. Schering markets Inhiston, a proprietary antihistamine identical to its ethical Trimtron, through its proprietary arm, Union Pharmaceutical, and under the Union label. (Schering is rather unique among ethical firms in even having such a division.) Burroughs-Wellcome, an ethical house, sells Empirin, a drug which is chemically identical to old, familiar Anacin pushed consumer-wise by Whitehall Pharmacal of American Home Products.

Nepera Chemical promotes the same drug in different fashions: as Anahist, through its subsidiary, Anahist Co., and ethically as Neohetramine.

Squibb, a venerable drug house, has moved its many products through both channels for years, satisfied that "low pressure" selling of certain medicines under the Squibb trademark to the lay public does not discourage acceptance by the medical profession of the company's ethical products.

▶**Signs of the Future**—Much of this, of course, has been going on for some time and doesn't point to a trend. If you're looking for a stronger portent, try the hydrocortisone ointment hassle.

Several ethical drug houses had petitioned the Food and Drug Administration to permit over-the-counter sales of this product. The FDA seemed favorably impressed with toxicity evidence when suddenly a clamor arose from doctors and dermatologists who warned of dangers in the non-prescription sale of this pharmaceutical formulation. The question is still up in the air.

Run down the list of companies who have registered interest in FDA approval of hydrocortisone ointment as an OTC item. When you see such names as Whitehall Pharmacal, Rexall Drug, both predominently proprietary firms—you wonder how these firms will promote the hormone ointment should it go OTC. And you wonder how the ethical manufacturers like Schering, Upjohn, Pfizer, Sharp & Dohme—who sell a lot of hydrocortisone in ointment preparations—will fare if they limit themselves to ethical promotion.

Upjohn ads have been recently appearing in consumer magazines, explaining in restrained fashion the character and efficacy of vitamins—a sort of institutional selling which, coming from an ethical stalwart like Upjohn, could be a sign of the future.

▶**Watch the Public** — Another development to watch is the tranquilizer drug boom. Don't be surprised if efforts are made to get FDA approval of over-the-counter sales of some of the milder types. If this happens, and there is bitter resistance to it for many reasons, the tempta-

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tion to promote these drugs on the open market will be very strong, indeed. (Please note that all the milder tranquilizers save one are products of ethical manufacturers with proprietary parents.)

In this age of psychoses, neuroses, complexes and myriad tensions, the public promises to be a soft touch for the therapeutic appeal these drugs seem to possess. And what the public wants the public seizes.

▶ **Public Hears, Public Wants**—Public awareness—awareness of new drugs, of what they can do—has led to enormous public demand for drug products. People pressure their doctors and druggists for medicine by prescription or over the counter.

Another kind of awareness is the acute consciousness ethical drug manufacturers now have of the man on the street as the ultimate user of their products, of the need to put their cases to him directly. The Salk vaccine ordeal brought this home with a thud.

▶ **Direct Approach**—Many well-esteemed, ethically-proven drugs are freely available to the public but are promoted only to the doctor and pharmacist. "If a product can be sold to the public then why not sell it to the public?" is a query that must be running through many an ethical drug man's mind.

▶ **Competition Levels**—The torrents of new drugs in recent years have been both boon and bane to the industry. Profits can be mightly impressive for a while on a first-of-its-kind product. Soon, though, there may come a rash of competitive products which hammer prices and profit margins down to where it's difficult to maintain early levels by ethical promotion. An over-the-counter variation of the original product, aimed at the mass market, could come in handy at this point.

▶ **The Coin's Other Side**—Now we come to the big *but*, a real big one, that has kept ethical drug firms clear of proprietary advertising and which might still negate all the factors we've mentioned favoring such a move.

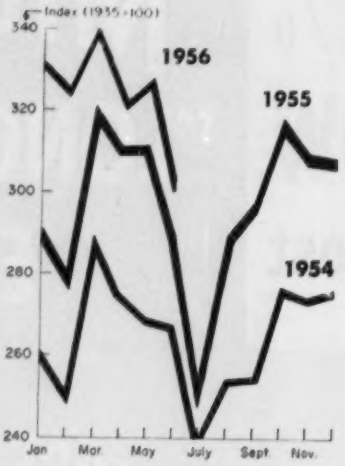
A cordial relationship with the doctor is an ethical pharmaceutical manufacturers most precious business asset. He hates to strain it, he's loath to do anything that smacks of usurpation of the physician's traditional prerogative to recommend what medicine shall be used for what ailment. He knows how the medical profession regards commercialism in medicine.

It's not quite as risky for a manufacturer already diversified in non-drug lines, like Pfizer, Merck and Olin-Mathison, or for one who is a relative newcomer to the ethical drug business.

But for people like Lederle, Upjohn, Lilly and Abbott who have built their businesses and prestige on ethical drugs for two generations and more, a move into proprietary channels is a very scary one—and they know it. Yet they are the ones who presumably need most to diversify.

So the question: "Can an ethical drug company gain more by the proprietary promotion of certain products than it will lose?" is a soul-searching one. But like it or not, it's a question that ethical drug manufacturers must ask and answer in the coming years.

Chemical Consumption



Consumption by Industries

	May (Final)	June (Est.)
Coal products	12.7	11.8
Explosives	12.0	11.9
Fertilizer	74.4	56.5
Glass	27.3	27.6
Iron & steel	19.2	17.8
Leather	4.1	4.1
Paint & varnish	35.3	35.2
Petroleum refining	31.8	31.4
Plastics	24.7	25.3
Pulp & paper	39.3	37.7
Rayon	27.6	24.9
Rubber	6.9	6.1
Textiles	11.0	9.3
Total	326	300

The 84th Congress And You

The second session of the 84th Congress ground out an impressive amount of legislation before closing shop July 30. Here's a rundown of the more significant items for chemical engineers that came through the legislative mill.

▶ **Water Pollution Control** — A new, permanent act went on the books authorizing a broad program of research, technical assistance, stronger federal enforcement powers against industrial and municipal polluters and federal funds to beef up state anti-pollution programs and help cities and towns catch up on heavy backlogs of needed sewage-treatment works construction.

▶ **Aid Primes Research** — Construction programs voted this year include:

• The National Science Foundation won a whopping hike in funds for basic research grants in chemical engineering and other technical fields, and for science teacher training. It will have $40 million to spend this year—compared to $16 million last year. Among other things, it will launch an expanded high polymer research program.

• The National Bureau of Standards and the Food and Drug Administration saw their hopes for new and larger working space realized. Congress gave NBS money to build a new 40-million-dollar headquarters in suburban Maryland (it will take another $20 million to equip) and approved a new downtown Washington office and lab building for FDA, at a cost of $12.2 million.

• The Interior Department's saline water research program

1906

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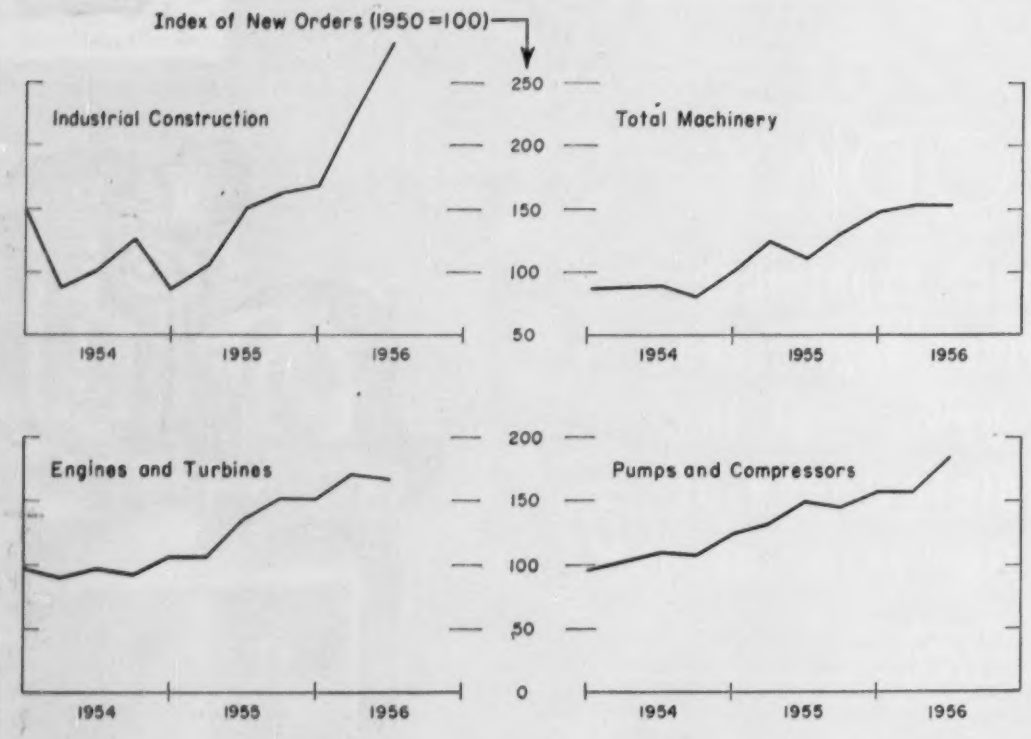
won a hefty boost in funds after reporting encouraging progress in developing commercially feasible processes for converting sea water and brackish water into fresh water.

• The Army Quartermaster Corps got $3 million for an experimental reactor to preserve food by nuclear radiation; Atomic Energy Commission will soon seek proposals to design and build it.

• The Federal Air Pollution Research Act, passed in 1955, was backed up by increased funds for 1957.

▶ **Tariffs, Subsidies** — Congress, after years of near-misses on the issue, enacted a bill to simplify customs procedures for American importers and their foreign suppliers. This red-tape cutting measure has some protections—though not all sought by chemical manufacturers—to keep tariffs on chemicals at present levels.

Domestic producers of acid-grade fluorspar, tungsten, asbestos and columbium-tantalum won a new stop-gap subsidy purchase program running to 1959.



Orders for Capital Goods Reflect Industry Optimism

A series of indexes of new orders for capital goods—machinery and industrial buildings—has been developed by the McGraw-Hill Department of Economics. As an advance indicator of business activity, these indexes are felt to have great significance. (The Index of new orders for machinery was reprinted in the 1955 and 1956 annual Economic Reports of the President.) Now under scrutiny: a program of forecasting new machinery orders a year ahead.

The charts above reflect dollar value of orders for non-electrical machinery and industrial buildings, are not corrected for price changes. Yearly average indexes for both engines & turbines and pumps & compressors went from 91 to 130 and 85 to 110, respectively, last year, promise to make still another big jump this year.

A representative cross-section of companies in the machinery industry report the dollar volume of incoming new orders each month.

The index of new contracts for industrial buildings covers contract awards (of $93,000 per project and up) for new buildings and major additions to plants in manufacturing, transportation, communications and public utilities.

this 58-page booklet contains the most comprehensive data ever compiled on

MALEIC ANHYDRIDE

If you use or may use Maleic Anhydride, you'll find a wealth of valuable data in this expanded, second-edition of our basic manual "National Maleic Anhydride".

It contains (1) the most complete tabulation of physical properties ever printed, many determined by National's Research Laboratory (2) 14 pages of chemical properties and reactions, copiously illustrated with 47 informative structural diagrams, (3) a graphic "family-tree" presentation of Maleic Anhydride derivatives and resulting end-products, (4) 17 pages of suggested uses with literature abstracts, and (5) a bibliography of 333 references!

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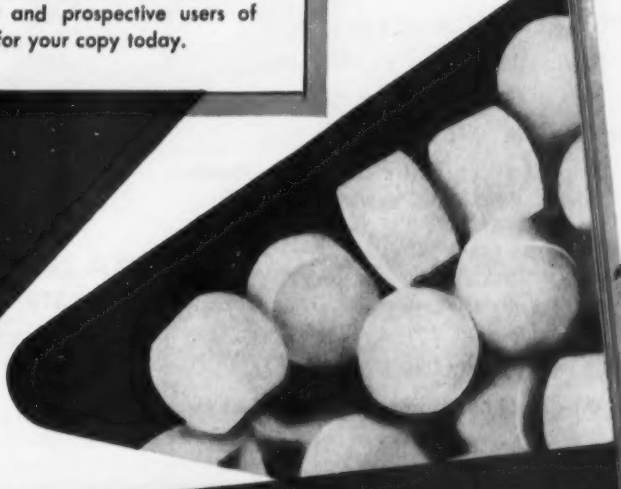

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8-3

It will cost the government $91 million to buy these minerals which will go to the national stockpile.

▶ **Government Still Selling** — The Rubber Facilities Disposal Commission, after selling 27 war-built government synthetic rubber plants over three years, went out of business September 23. (The Louisville alcohol butadiene plant, sold and then not-sold, carries no restriction that it must be available to produce butadiene for 10 yr.)

Congress has okayed efforts to sell two other war-built industrial facilities—the Texas City tin smelter and the Akron rubber labs and pilot plant. General Services Administration will handle sale of the rubber labs under terms expected to yield offers of around $3 million. Federal Facilities Corp. has invited proposals for the tin smelter, reports interest from firms contemplating processing to extract tungsten and other metals, with refined tin as a by-product.

GUIDED TOUR CONTINUED

PICTURED FLOWSHEET

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Nitric way to fertilizers

Joining fast-coming trend, Calspray turns from sulfuric to nitric acidulation in fertilizer manufacture at its new Richmond, Calif. plant. Developed during sulfur (and sulfuric) shortage nitric route promises cheaper product. (p. 358)

Talent on parade

Biographies and backgrounds of your authors add weight and importance to their contributions in this issue. (p. 384)

Technical Literature

You can get—free and fast—literature on any subject in your field. Keep files up to date the easy way. (p. 446)

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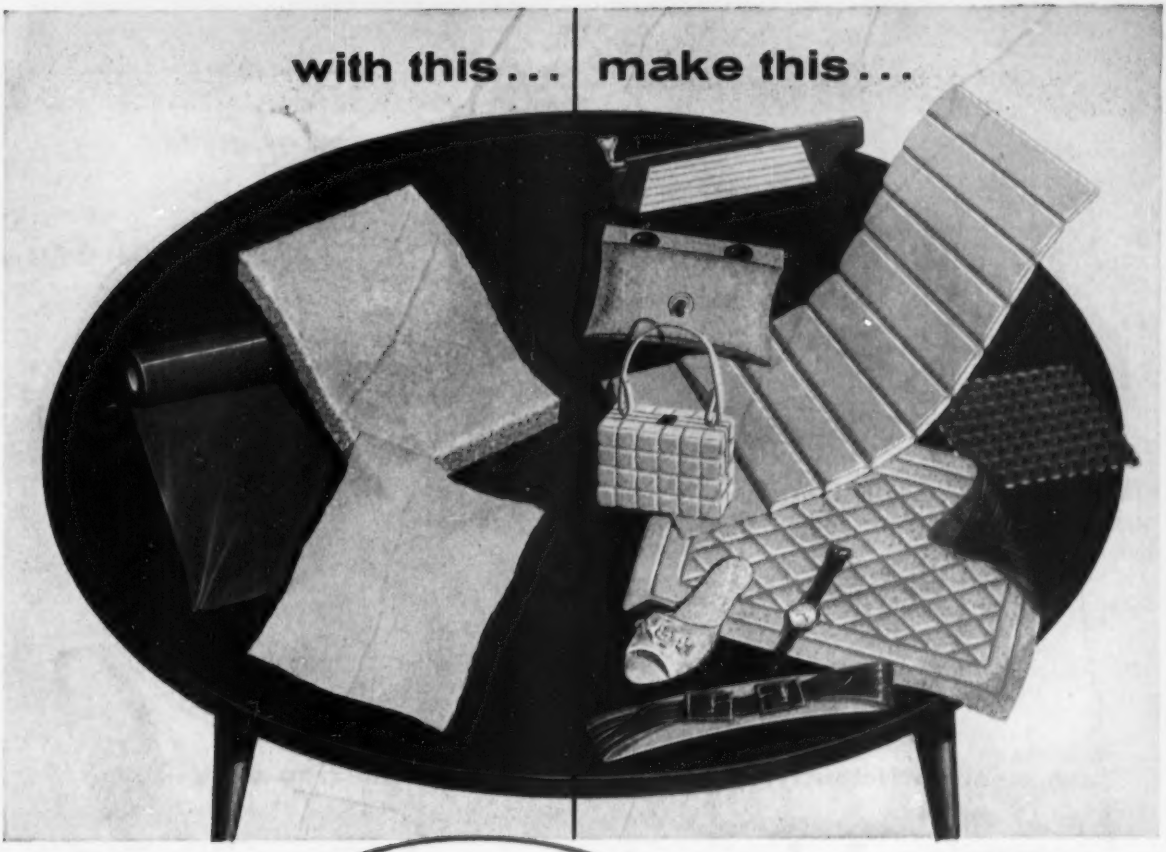
Inside Back Cover



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Development of *heat-sealable* Vinyl-foam, makes new quality, new ideas possible in hundreds of products that require cushioning or softness, fashionably molded contours, eccentric or specially-designed shapes, quick-quilted and embossed surfaces.

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You get this high capacity in Nicholson steam traps through effective use of a large orifice. And you get much more—simplicity of design and quality through and through.

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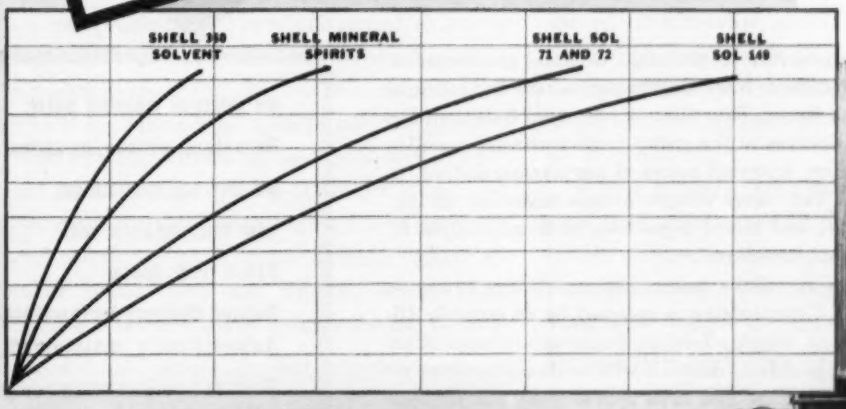

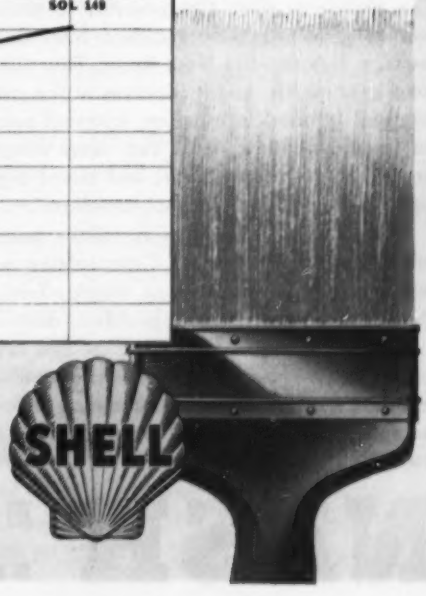

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The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

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No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature Automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

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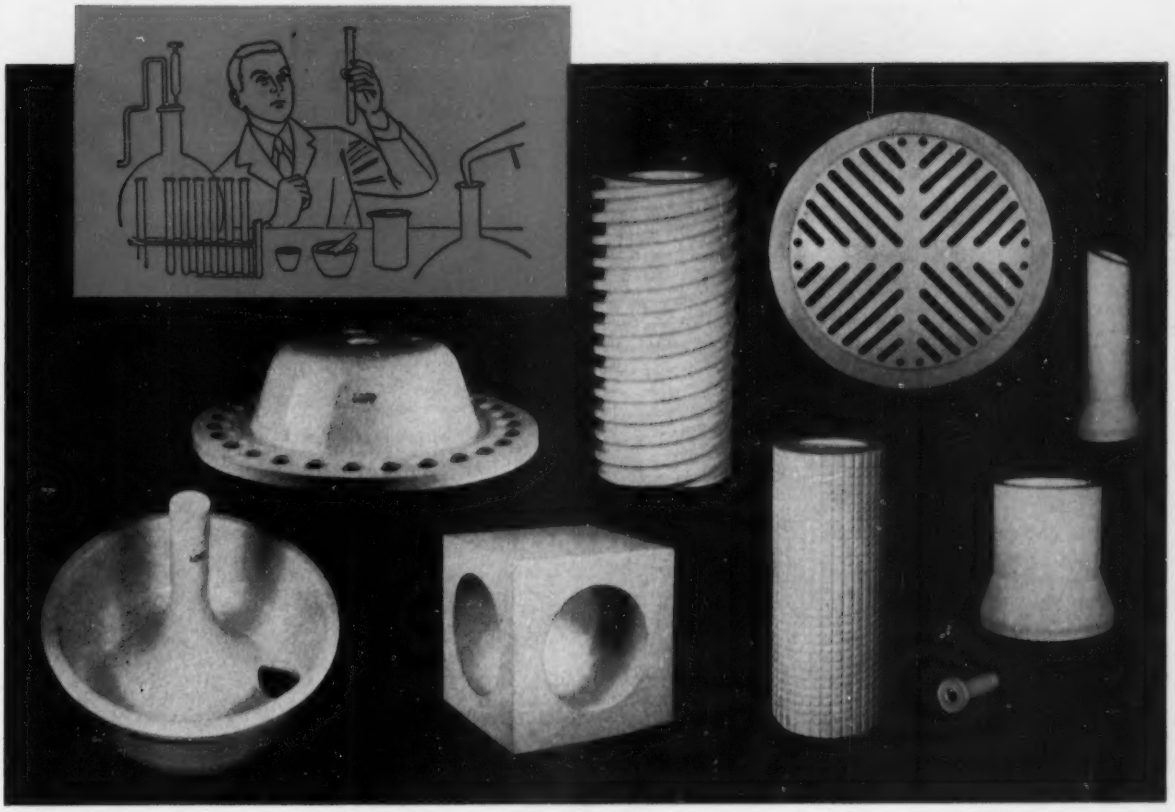

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Don't sacrifice purity when putting a new process into production. There's no reason to search for substitute materials that *might* duplicate laboratory results . . . use the *same* materials in which the laboratory worked out the process. That's right! Porcelain, the world-wide standard for laboratory purity, is available in Lapp Chemical Porcelain equipment for pilot plant *and* industrial production. A wide variety of valve styles, pipe and fittings, towers and raschig rings and many special shapes, including custom pieces for your specific requirements, are available, and at costs much less initially than many types of special alloy or lined equipment. Lapp Porcelain is chemically inert, hence corrosion resistant—it usually requires no maintenance.

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Now on the USS Saratoga
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On the powerful *Forrestal*...on the sleek atomic subs, the *Nautilus* and *Seawolf*...now on the mightiest *USS Saratoga,* Unibestos pipe insulation guards against heat loss.

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By providing these unique standards of insulating efficiency, Unibestos makes its contribution to the important Navy development program. In addition to the marine field, single-layer Unibestos is fast becoming the preferred pipe insulation for more and more power plants, refineries, chemical plants and other modern industrial projects.

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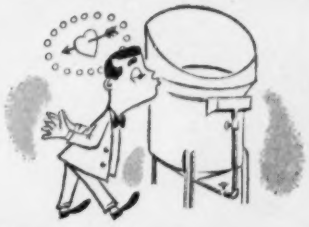
Using Salt Efficiently

by **INTERNATIONAL SALT COMPANY, INC.**—America's largest producer of salt



You Can Save Money on Water Softening—With a "Lixator"

Today, a great many companies using zeolite water softeners are faced with this problem: While the water softener (which needs periodic regeneration with brine) gives excellent performance—regeneration is often costly, time-consuming, and causes substantial waste of salt. This is generally the case when salt is dissolved to form brine without the proper controls.

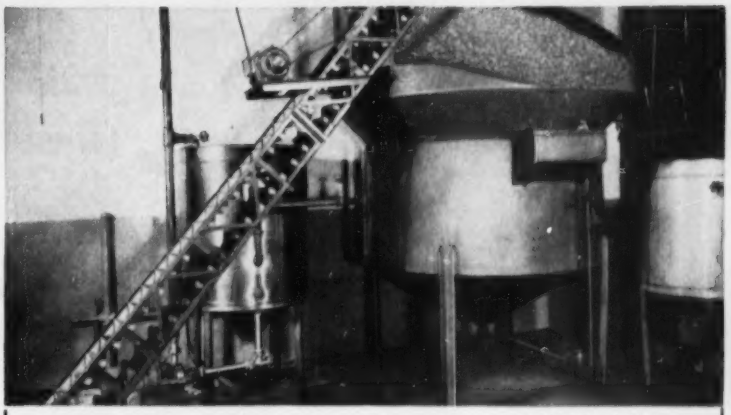
In most plants, however, it *is* possible to reduce this high cost of water-softener regeneration. The method is simple and effective: Always regenerate with pure, fully saturated brine—the type of brine made in a Sterling Lixator. Here are some of the reasons why Lixate Brine can save money for users of zeolite water softeners . . .

The Sterling Model Lixator is the most efficient and economical rock-salt dissolver ever developed. Wherever this fully automatic unit is used in water softening, it reduces the amount of salt consumed . . . eliminates dry-salt spillage . . . and simplifies the entire brine-making process. Developed and patented by the International Salt Co., the Lixator combines rock-salt dissolving and brine filtration in one simple operation. It delivers fully saturated crystal-clear brine *automatically* to any point within a plant. The Lixator is also remarkably easy to maintain, and has no moving parts to get out of order.

In operation, a Lixator need not replace the salt-dissolving tanks furnished by water-softener manufacturers. Instead, Lixate Brine is piped to these tanks—which then serve as the storage and measuring tanks from which brine is withdrawn for use.

Salt handling reduced. Because Lixate Brine is *piped* to points of use, the work of hauling dry salt from storage piles to the location of the water softeners is eliminated. Also, because of this direct-piping feature, the Lixator (and the salt that feeds it) can be placed anywhere in the plant, to make the most efficient use of available space. With a self-feeding hopper for salt, the Lixator operates automatically, without attention, and with little or no salt handling.

Lixators are made in a variety of types and sizes— to meet the brine needs of individual plants. The principle by which they operate can benefit the largest factory, or even a plant of moderate size.



At the Libby, McNeill & Libby plant in Hartford, Wisconsin, this Sterling Model Lixator is used for efficient, low-cost water-softener regeneration. A mechanical conveyor fills the Lixator hopper from a nearby rock-salt storage pile. In *your* plant, a Lixator can also produce substantial savings on salt—and in salt handling as well.

Complete regeneration. Since Lixate Brine is always 100% saturated, it provides complete water-softener regeneration each time. This means that extra regenerations—with the consequent use of more salt— are eliminated. Still another advantage results from using Lixate Brine: Water-softener operators will not use any more of this brine than is needed for each regeneration. What often happens in the case of unsaturated brine is that excess amounts are used in an attempt at complete regeneration. In the long run, this always results in a costly waste of salt.

Keeps water softeners clean. Besides being fully saturated, Lixator Brine—produced in a Lixator from economical grades of Sterling Rock Salt—is also self-filtered, and free from insolubles or other foreign matter. As a result, it will not introduce dirt or other "clogging material" into the zeolite bed of the water softener. This has proved to be a particular advantage in industrial water softening—because the zeolite stays in good condition longer. Lixate Brine is also free from acids or alkalies. Thus, being neutral, it cannot adversely affect the performance of any zeolite water-softening system.

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If you'd like the assistance of an International "Salt Specialist" on any problem concerning salt or brine—or further information on water-softener regeneration—just contact your nearest International sales office.

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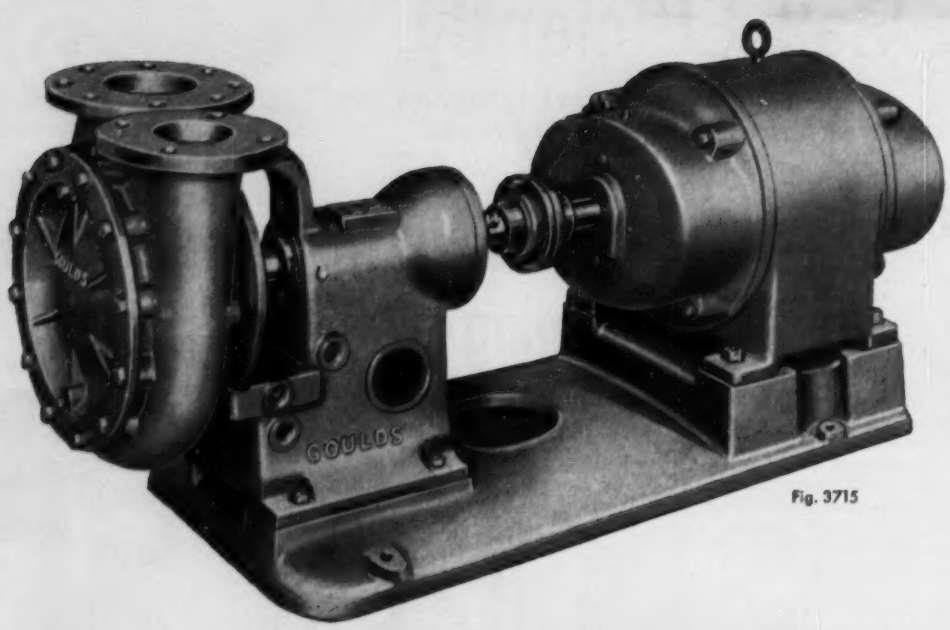

Fig. 3715

Here's a pump especially designed for your **ABRASIVE** and **CORROSIVE** liquids

You minimize your "hot" pumping problems — and expenses — with Goulds chemical pumps because *they're built to take it!*

With the Fig. 3715 pump, you can handle liquids that would "murder" most pumps. Such liquids as acid, alkaline liquor, hot size, and slurry. But this pump offers more than just severe service design. You get fewer maintenance problems plus special operating advantages.

Look at the support head—its rugged, box-type design with water jacket permits you to pump liquids as hot as 350° F. Over-lubrication is prevented by grease-lubricated standard bearings with grease relief. You can adjust impeller clearance without any dismantling by means of a simple, positive external arrangement.

A variety of construction materials meets every need. Goulds Fig. 3715 pumps come in Type 316 and Gould-A-Loy 20 stainless steel, all aluminum-bronze, all iron or bronze-fitted.

There's a wide range of sizes, too —nine in all—with capacities up to 720 GPM and heads to 200 feet. You can keep a low spare parts inventory since many of the parts are standardized for interchangeability between sizes.

There are many more reasons why you can save money and avoid maintenance headaches by pumping those harsh liquids with a Goulds Fig. 3715 pump. Learn about them by addressing your inquiry to Goulds Pumps, Inc., Seneca Falls, N. Y.

Ask for Bulletin 725.4.

Here is a Goulds pump handling hot fatty acids in an oil processing plant.

Here are three Goulds chemical pumps circulating hot size in a textile plant.

Goulds stainless steel pump handles corn meal mush in a food plant.

Goulds PUMPS INC. Seneca Falls New York

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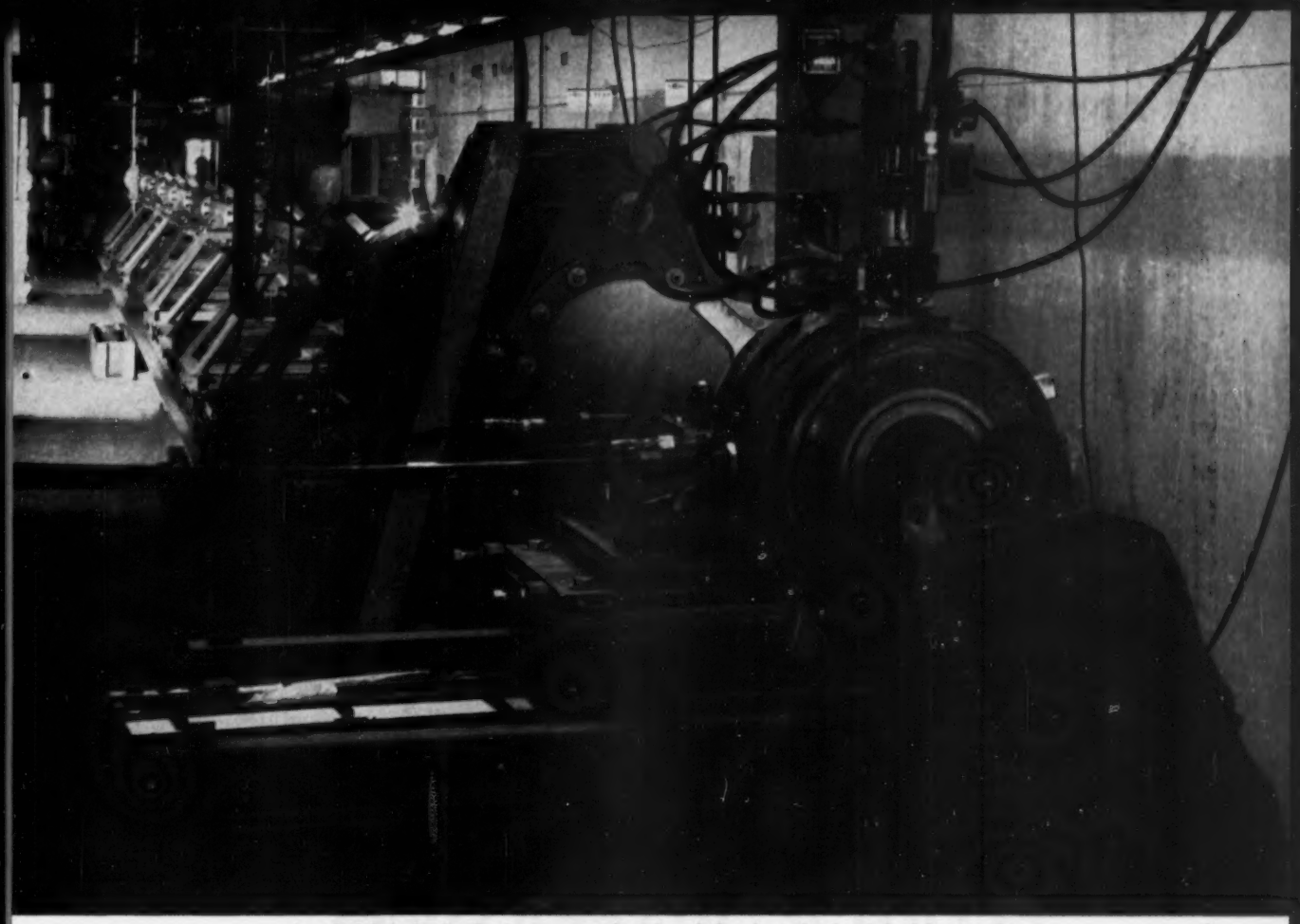

A technician checks the ALCOPLATED *interior of the giant shock tube's driver section.*

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Chemically deposited nickel-phosphorus ALCOPLATE, providing protection from erosion and corrosion in this unusual application, can mean savings and process equipment protection in normal industrial applications, too. Inquire at the nearest ALCO Sales Office or write to P. O. Box 1065, Schenectady 1, New York for further information.

*ALCOPLATE — Trade-mark registration applied for. An application of "Kanigen" a mark identifying the chemical deposition of high-nickel, low-phosphorus alloy by General American Transportation Corporation and its licensees and the coating resulting therefrom — on license from General American Transportation Corporation.

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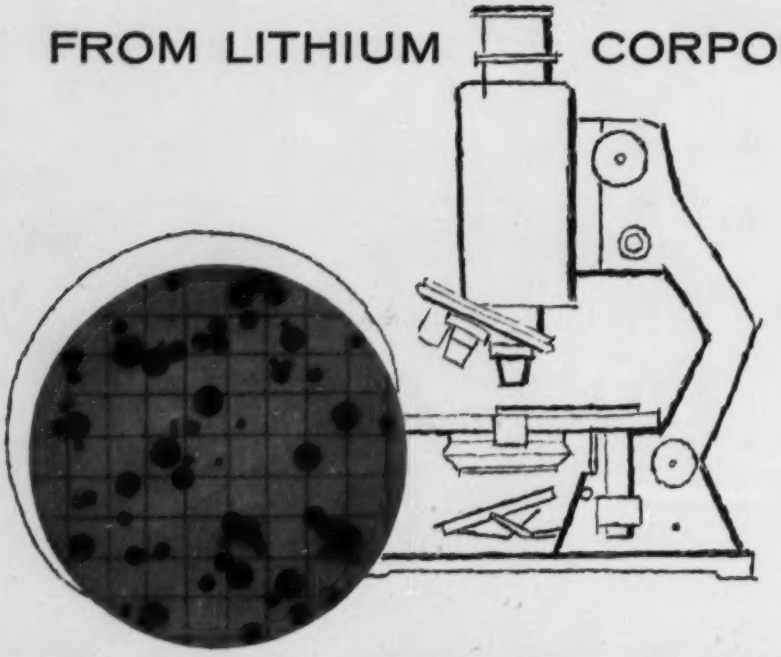

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... trends ahead in industrial applications for lithium

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Two, Three, Four Separations ... one outlet for each different size product. Collars and adjustable changes provide for quick attachment of flexible outlet tubes.

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Quiet, Vibrationless Operation assured by dynamically balanced mechanism.

Product Quality Protected. Gentle motion minimizes disintegration of foreign particles.

Secure, Vibrationless Foundation provided by sturdy, all-welded steel base.

You Get MORE When You Specify ALLIS-CHALMERS

Top efficiency in screening ... maximum capacity ... profit-insuring quality control ... quick 'n' easy sanitation ... simplified maintenance ... economical operation — all these important advantages are yours when you specify Allis-Chalmers.

Your Allis-Chalmers representative will be glad to tell you more about this newest and finest of gyratory screens. Call him. Or write for descriptive Bulletin 07B8446. Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

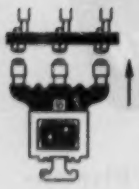
A-5074

ONLY ONE MOVING PART
NO PINS—NO PIVOTS

One-piece solenoid plunger, operating in friction-free guide, carries the cadmium silver moving contacts. Trouble free design.

DOUBLE BREAK
SILVER ALLOY CONTACTS

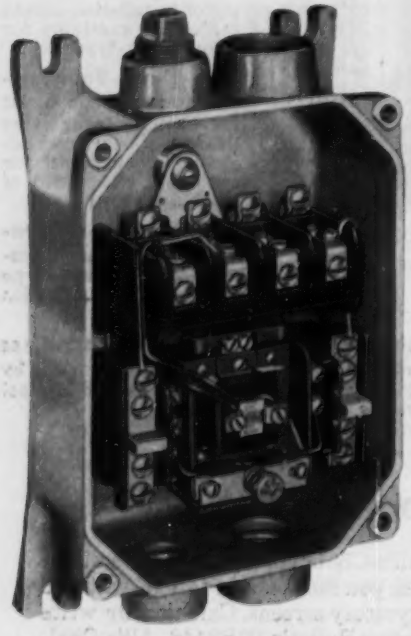
The Allen-Bradley double break, silver alloy contacts are always in good condition. No contact maintenance is required.



NO LINKAGES or
FLEXIBLE JUMPERS

The straight-line, up-and-down movement of the solenoid plunger opens and closes the double break contacts. Nothing could be more simple and, therefore trouble free.

Allen-Bradley Bulletin 709 Solenoid Starter in NEMA Type 4 weatherproof and watertight enclosure



The Allen-Bradley line of solenoid across-the-line starters is available in the following additional enclosures: NEMA 1—General-purpose use; NEMA 7—Class 1, Group D hazardous location; NEMA 8—Corrosion-proof hazardous location; NEMA 9—Class 2, Group G hazardous location; Class 11—Corrosion-proof; Class 12—Dust-tight, industrial use.

For unusual conditions, selecting the "correct" enclosure will prove a money-saving investment

Enclosures for dusty or hazardous locations cost more than general-purpose sheet metal enclosures, but they are worth the difference. Bolted enclosures keep out destructive dust or fumes, and since Allen-Bradley solenoid starters require no contact maintenance, the bolted covers present no maintenance problem.

You can install Allen-Bradley starters . . . and forget them. And, of course, the thermal relays, which can be reset without opening the enclosure, protect the motor against burnout due to sustained overloads.

Allen-Bradley Co.
1337 S. First St.
Milwaukee 4, Wis.

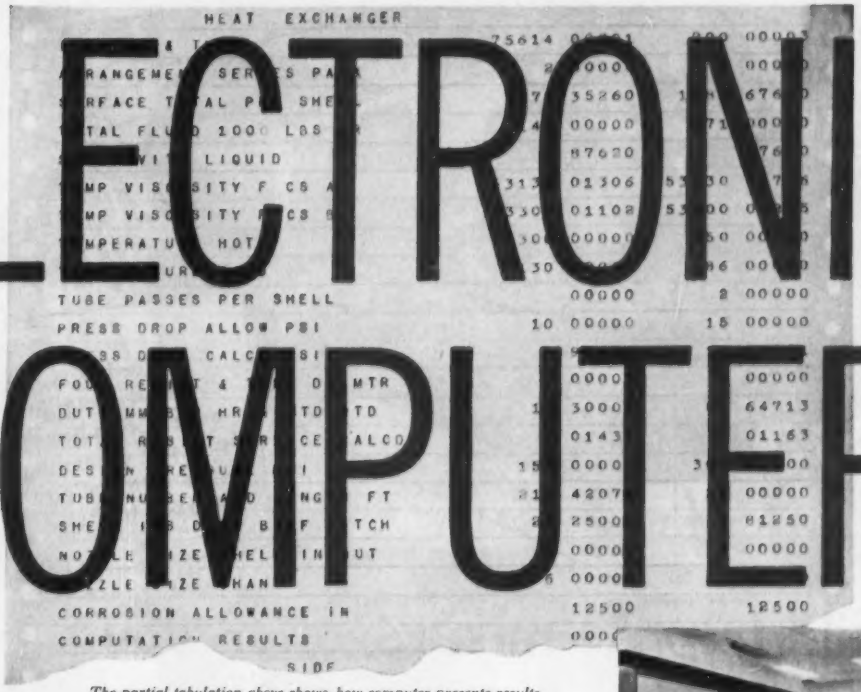
In Canada—
Allen-Bradley Canada Ltd.
Galt, Ont.

ALLEN-BRADLEY

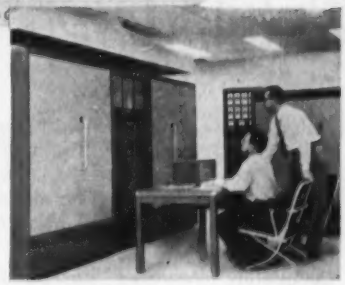
SOLENOID MOTOR CONTROL

QUALITY

More Precise Design Calculations with M. W. Kellogg's New, Super-Speed ELECTRONIC COMPUTER



The partial tabulation above shows how computer presents results. The computer itself is shown at the right.



The latest addition to The M. W. Kellogg Company's facilities for engineering heat-pressure process equipment is a new, large magnetic drum digital computer. It can execute 500 arithmetical operations per second; conservatively can solve 40 simultaneous equations in 30 minutes; and has a memory capacity of over 4000 ten-digit words.

This new computer enables M. W. Kellogg's engineering staff to undertake a far greater number of precise calculations in less time than ever before and, as a result, to determine the optimum designs for customers in minimum time. For example, complete calculations for a liquid to liquid heat exchanger, which formerly took 10 to 15 hours, now can be done in about 15 minutes.

Electronic computation is an important supplement to the productivity of Kellogg's heat transfer engineers and permits them more time for evaluating results and improving designs. We welcome the opportunity to demonstrate what these aspects of Kellogg's "built-in engineer" can contribute to your requirements.

Fabricated Products Division THE M. W. KELLOGG COMPANY 711 Third Avenue, New York 17, N. Y.

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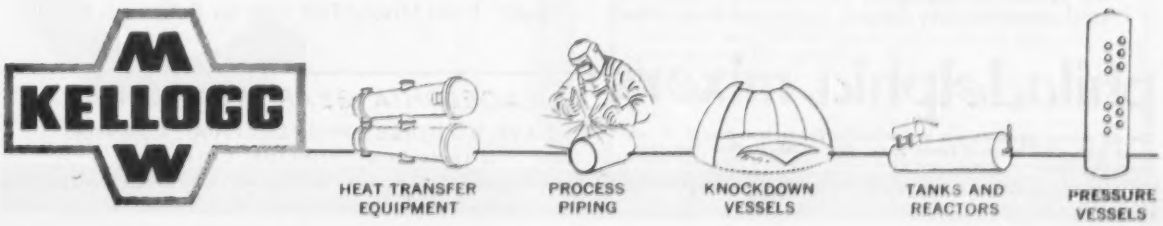

today's TREND is toward "Packaged" FLUID MIXERS

Gear reducers, motors, motor supports, couplings, shafts, impellers, and base mountings . . . all pre-assembled for quick, easy installation and operation on your tanks.

. . . philadelphia mixers offer you more value per dollar . . .

You can now solve any fluid mixing problem with Philadelphia "packaged" Fluid Mixers . . . eliminating the usual expensive, complicated equipment. By standardizing on simple, easily maintained Philadelphia Fluid Mixers, you get these proven advantages!

Completely integrated "packaged" service. Philadelphia designs, and manufactures in one plant, every major component of these fluid mixers, except motors and bearings. As a result, through this one centrally controlled, thoroughly responsible source, you can obtain the complete solution to your fluid mixing problems.

Service-Rated Motors. Standard NEMA frame motors for any operating condition can be supplied. Special mountings, variable speed drives or special motors are available.

Quick-Change Gear Drives. Easily accessible, helical change-gear set allows ready selection up to 14 different standard speeds to meet your changing process needs. Spiral bevel gears of hardened steel are accurately lapped, assembled in matched pairs and micrometer tested for long, quiet operation. All drives are A.G.M.A. rated.

Full Range of Sizes. Choose the Philadelphia Mixer best suited to your needs. Six basic models from 1 to 100 HP. Keep in mind that Philadelphia Gear can build to sizes and specifications larger than usually available.

Unitary Mechanical Shaft Seal. Positive leak-proof shaft seal for closed tank agitation gives long maintenance-free service life. When necessary, it can be installed and replaced in minutes with only a wrench. No special lifting equipment is needed.

Heavy Duty Shafts & Bearings. Extra large heavy-duty output shafting results in less shaft deflection at stuffing box or mechanical seal, steady operation of overhung mixer shafts. All bearings are oversize, with a generous service factor.

Doesn't it stand to reason that these advantages add up to a bigger, better-designed, more powerful unit for your money? It won't cost you a cent to find out more about the new Philadelphia "packaged" Fluid Mixers. Just write for Bulletin A-156.

philadelphia mixers

See the newest developments in Mechanical Power Transmission at our booth #80—22nd National Power Show, New Coliseum, New York City, November 26-30.

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ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
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Engineers with their eyes on the future can readily see the ground floor possibilities of expanding their own careers in such a rapidly expanding new industry. (Chemstrand has expanded five times in five years of operation – with the biggest expansion yet to come.)

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Gentlemen:
It is my understanding that you need for immediate employment graduate engineers in various fields, particularly chemical, mechanical, industrial, textile and instrument engineering
I am a graduate _____ engineer.
Please send me information concerning the ground floor opportunities at Chemstrand.

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TOMORROW'S BIG DECISIONS WILL BE MADE by the men who act today . . .

Simple Arithmetic...
Type 302, Sheet Base Price 47.50 cents per lb.
Type 430, Sheet Base Price -36.75 cents per lb.
Saving 10.75 cents per lb.
in Stainless SHEET Costs!

Now you can SAVE $215 per ton in base price alone!

Many designers and fabricators who are currently using Type 302 stainless can, in numerous applications, specify Type 430 straight chromium stainless and take advantage of the 10¾ cents per pound difference in base price. Some of our customers are already saving more than $215 per ton using our 430 MicroRold stainless sheet.

The steel industry estimates that 50% of all stainless sheet applications could satisfactorily employ Type 430, the least expensive of all stainless grades, as an economical and practical material. When properly applied, Type 430 has all the desirable qualities of beauty, corrosion resistance, strength, long life and low maintenance that no other material, except stainless, can offer.

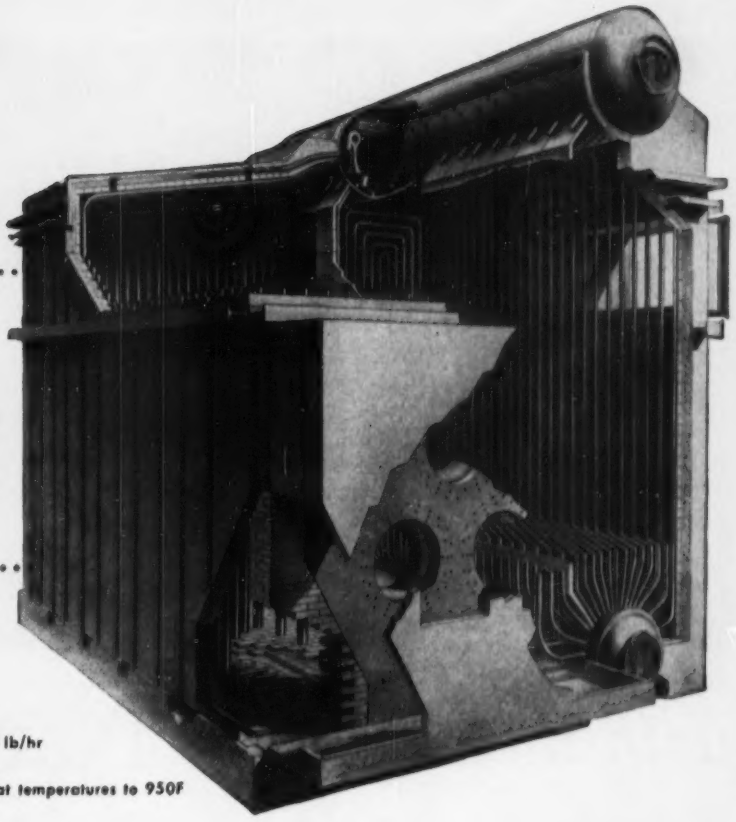
We are currently producing our MicroRold Type 430 sheets up to 48" wide in thicknesses .005" to .109" with 2B or 2D finishes; and in thicknesses .010" to .109" in No. 3, 4 and 7 finishes.

Send for Your copy, "Care and Use of 430 MicroRold Stainless Steel"

Washington Steel *Corporation*

10-S WOODLAND AVENUE, WASHINGTON, PA.

Series "SC" STANDARD Steam Generator



FUELS: Oil or Gas
CAPACITIES: 50,000 to 150,000 lb/hr
STEAM PRESSURES: to 1500 psi
STEAM TEMPERATURES: Superheat temperatures to 950F

PRE-ENGINEERED FOR SAVINGS

in first cost, installation, operation, maintenance

Series "SC" Steam Generator is of the pre-engineered, standardized design, with all exterior and structural details fixed. Available in nine sizes, with capacities of 50,000 to 150,000 lbs steam per hr, it incorporates many advanced design features – as noted in the accompanying list – that make possible important savings in industrial steam costs.

Burners, controls, upper drum mountings and other equipment requiring attention are located at the front of the unit. Heat recovery equipment and fans can be placed near the operating aisle for either single or multi-unit installations, providing unusual accessibility and ease of operation.

Write us today for further information on how the Series "SC" Standard Steam Generator can meet your individual plant needs for power or process work. *Foster Wheeler Corporation, 165 Broadway, New York 6, New York.*

FEATURES AT A GLANCE

- Completely water-cooled furnace
- Over 19-foot firing depth
- Unrestricted circulation
- All-welded casing
- Fully drainable superheater
- Efficient convection surface
- Bottom supported unit
- Steam purifying system
- Full insulation

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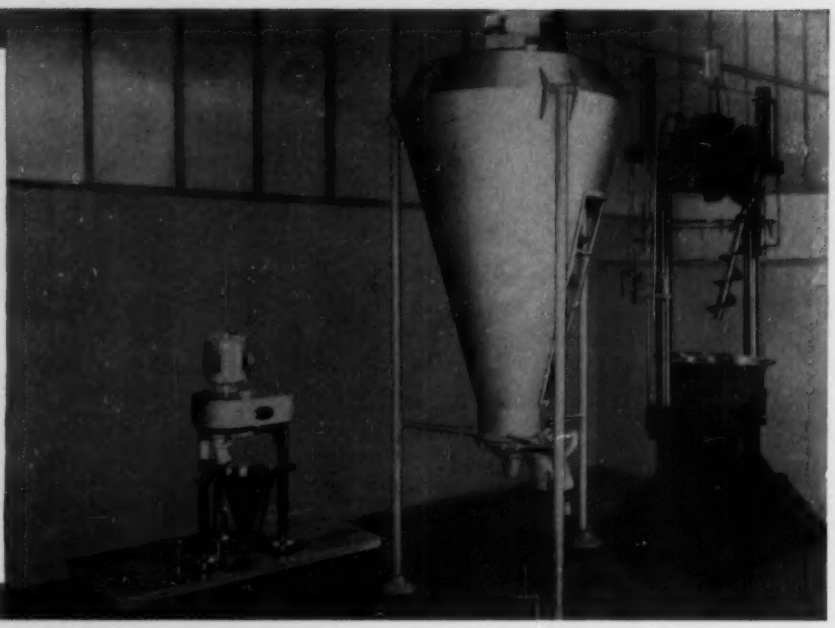
NOW quick, thorough mixing of dry products



with the NEW Nauta Mixer

Precessional motion of Nauta speeds production... cuts costs

Uniform, *quick* mixing of any number of dry materials in any proportions . . . wetting dry materials with small quantities of liquid . . . or dissolving solids in a liquid media . . . these are the exclusive features of the *new* Nauta Mixer. The gentle, yet positive action of the precessional motion of the Nauta intimately mixes products in any proportion . . . without dusting or change in their original characteristics.

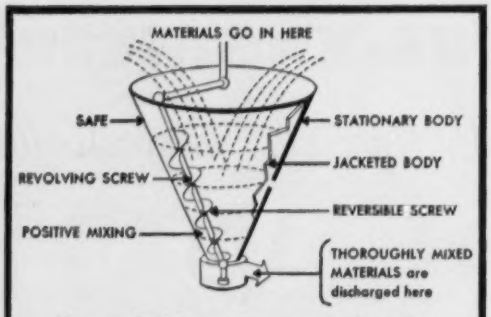
By shortening time cycles required for thorough mixing, the Nauta Mixer increases production. The revolutionary precessional motion means less power consumption. This is a combination that results in substantially lower costs.

Why not try the *new* Nauta Mixer in your operations? We will gladly send complete information on request.

Let us Pretest your product

A quantity of your product ingredients can be mixed under actual production conditions in a Nauta Mixer now in the Buflovak Research Laboratory and Testing Plant, with positive results. Let us tell you about this service.

ASK FOR BULLETIN NO. 374



For profitable use in many industries

The advantages of Nauta Mixers can be enjoyed wherever dry materials require thorough mixing.

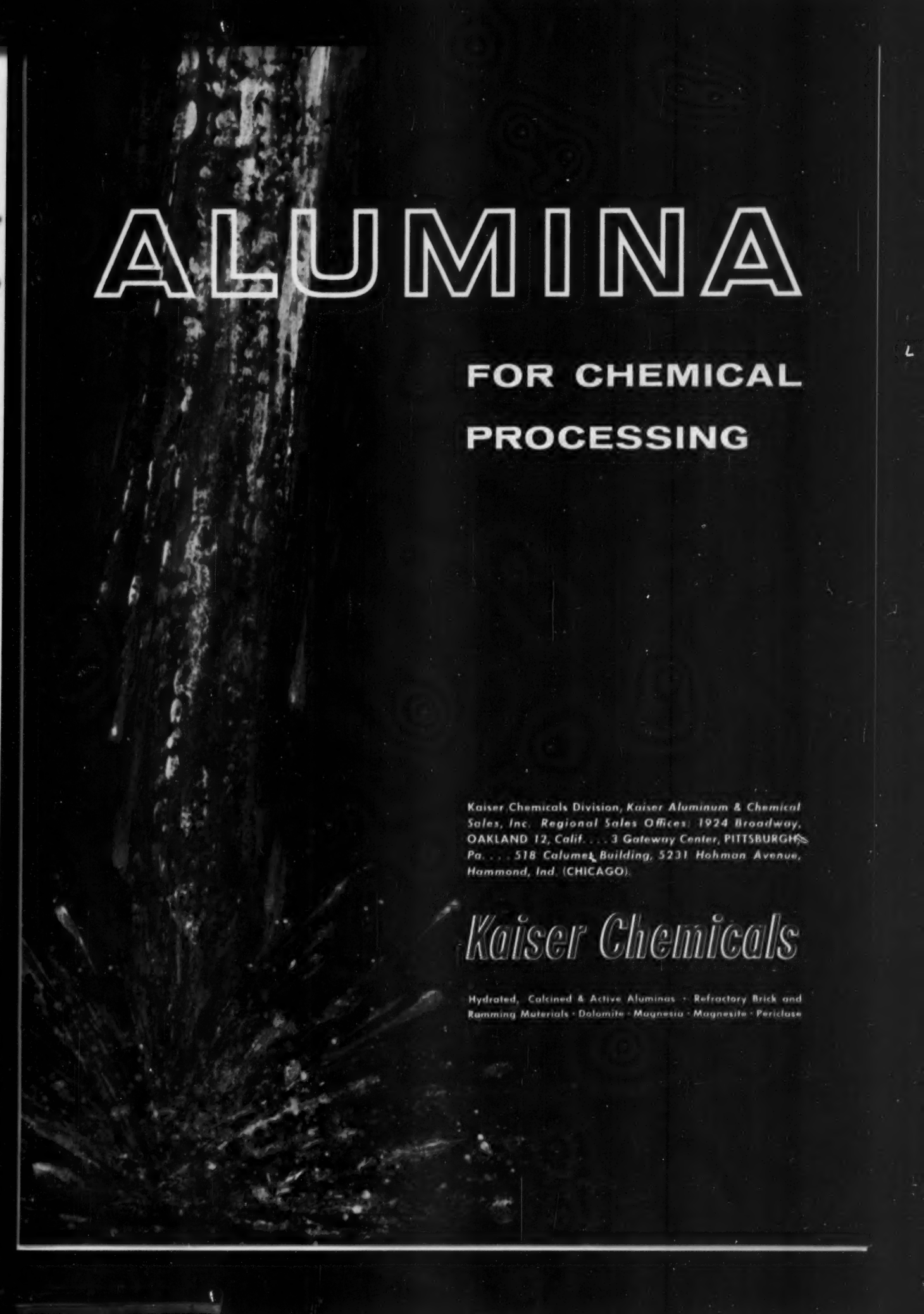
Agricultural products	Meat
Ceramic materials	Metal powders
Chemicals	Paint pigments
Cosmetics	Pharmaceuticals
Dissolving viscose rayon	Resins and plastics
Fertilizers	Seeds
Fish meal	Sizing compounds
Flour	Starch
Food products	Sugar
Insecticides	Many other products
Latex mixed with chemicals	

The Buflovak Equipment Division of Blaw-Knox Company is the exclusive licensee for the Nauta Mixer. It is built to the same exacting standards for which Buflovak is famous in building evaporators, dryers, autoclaves, kettles and other equipment.

50th Anniversary BLAW-KNOX 1906-1956

BLAW-KNOX COMPANY

Buflovak Equipment Division, 1551 Fillmore Avenue, Buffalo 11, N.Y.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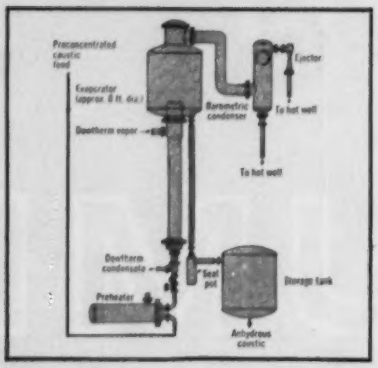


Schematic drawing of Swenson Evaporators. In these units, jacketing is eliminated: thermal insulation prevents freeze-up. Low-carbon nickel tubes, tube sheets, shells and piping keep corrosion low and prevent product contamination.

You don't have to "shade" solid NaOH made in Nickel

What's more...

- **With good control of chlorate, metal pick-up does not exceed 1 or 2 parts per million.**
- **Original equipment costs only 1/5 as much as a batch-finishing, direct-fired, iron pot installation of equal capacity.**
- **A set of nickel tubes can finish some 17,000 tons of caustic and costs less than 1/2 as much to replace as pots.**

Modern practice is to produce 99.5% solid NaOH continuously in Dowtherm*-heated evaporators with contact surfaces of corrosion-resisting low carbon Nickel. The chlorate-free feed is either 50 or 73% NaOH.

"Shading" pots have never been needed. Caustic is packed directly from the nickel storage tanks.

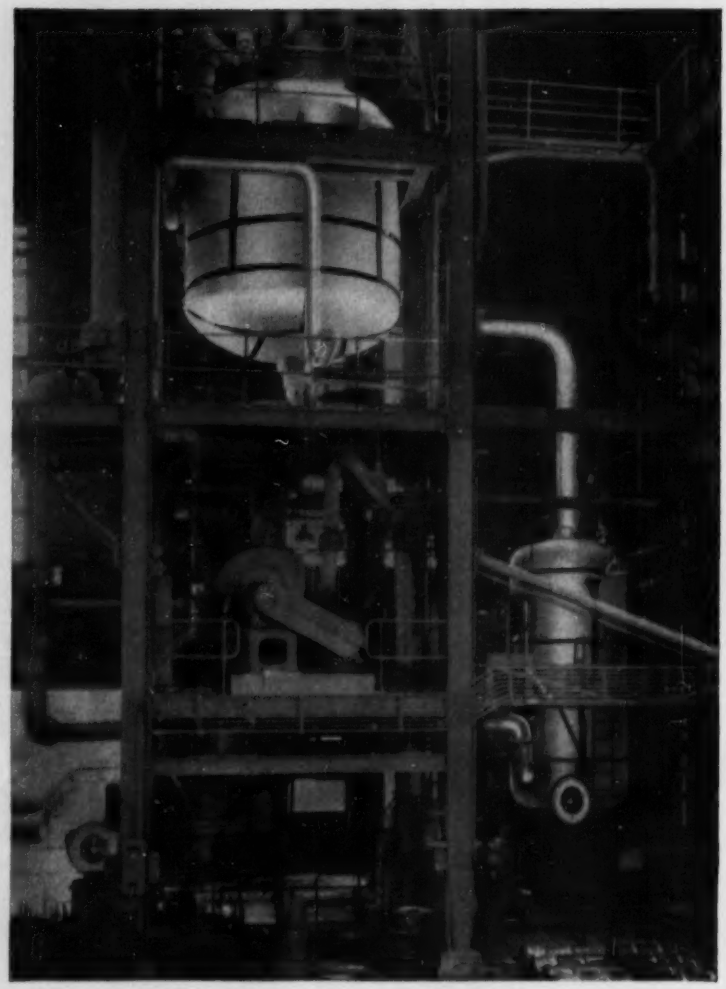
*Trademark of Dow Chemical Company

For further information on continuous caustic finishing units, write Swenson Evaporator Company, Harvey, Illinois. For assistance with caustic corrosion problems, contact Inco's Corrosion Engineering Section.

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK **Nickel**

. . . for purity



Continuous finishing of anhydrous caustic soda in Swenson Evaporators has proved highly economical. This is one of the latest units, installed at Murgatroyd's Salt and Chemical Co., Ltd., England.

This information of continuous caustic finishing is published through the courtesy of the Swenson Evaporator Company and Dr. W. L. Badger, originator of the process and designer of the unit.

TURBA-FILM process unit

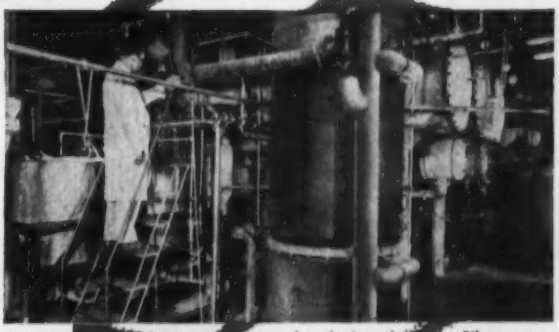
Reduces original equipment investment
Cuts steam and operating costs
Produces higher concentrate

Swift & Company specified the Turba-Film® process unit for concentrating gelatin liquor at their Kearney, New Jersey plant.

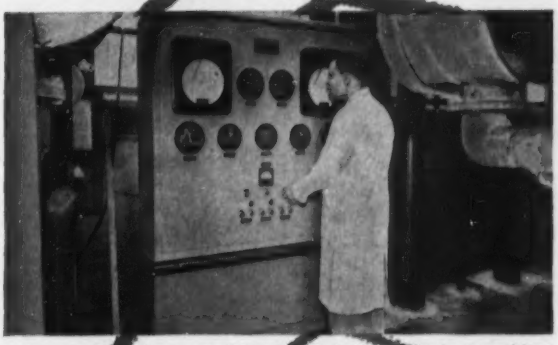
In this single-pass continuous operation the thin film of gelatin liquor spirals downward under continuous, turbulent agitation by the rotor blades. Heat transfer rate is extremely high since each particle of material is in contact with the heated surface for only a few seconds. There is no "cooking" or loss of flavor because there is no localized overheating; basic properties of the product are retained in the concentrate.

Gelatin poses many problems in processing because of its low heat transfer, tendency to foam, variations from initial to final viscosity, and heat sensitivity. The Turba-Film process unit is successfully solving these and many other problems throughout the chemical and allied process industries.

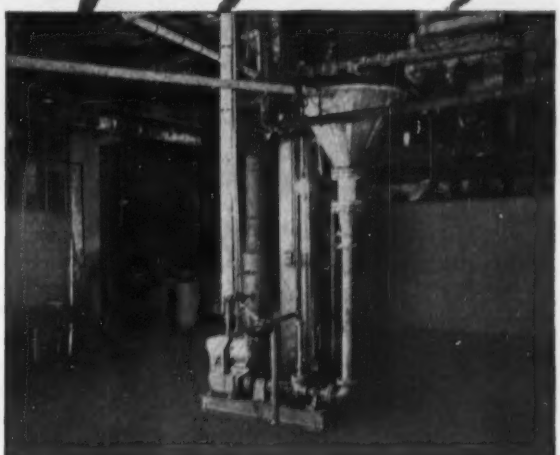
Without obligation, Rodney Hunt would like to discuss how the Turba-Film process unit can help you in normal or specialized applications, either as an individual unit or as part of completely engineered "package systems". Write for literature.



Gelatin li… from …ess steel tanks into th… Turba-Film process unit at Swift & Co. Thi… unit.



Instruments s…n here control heat … gelatin liquor. Feed rate and heat are closely c…trolled during this …ntinuous single-pass operation.



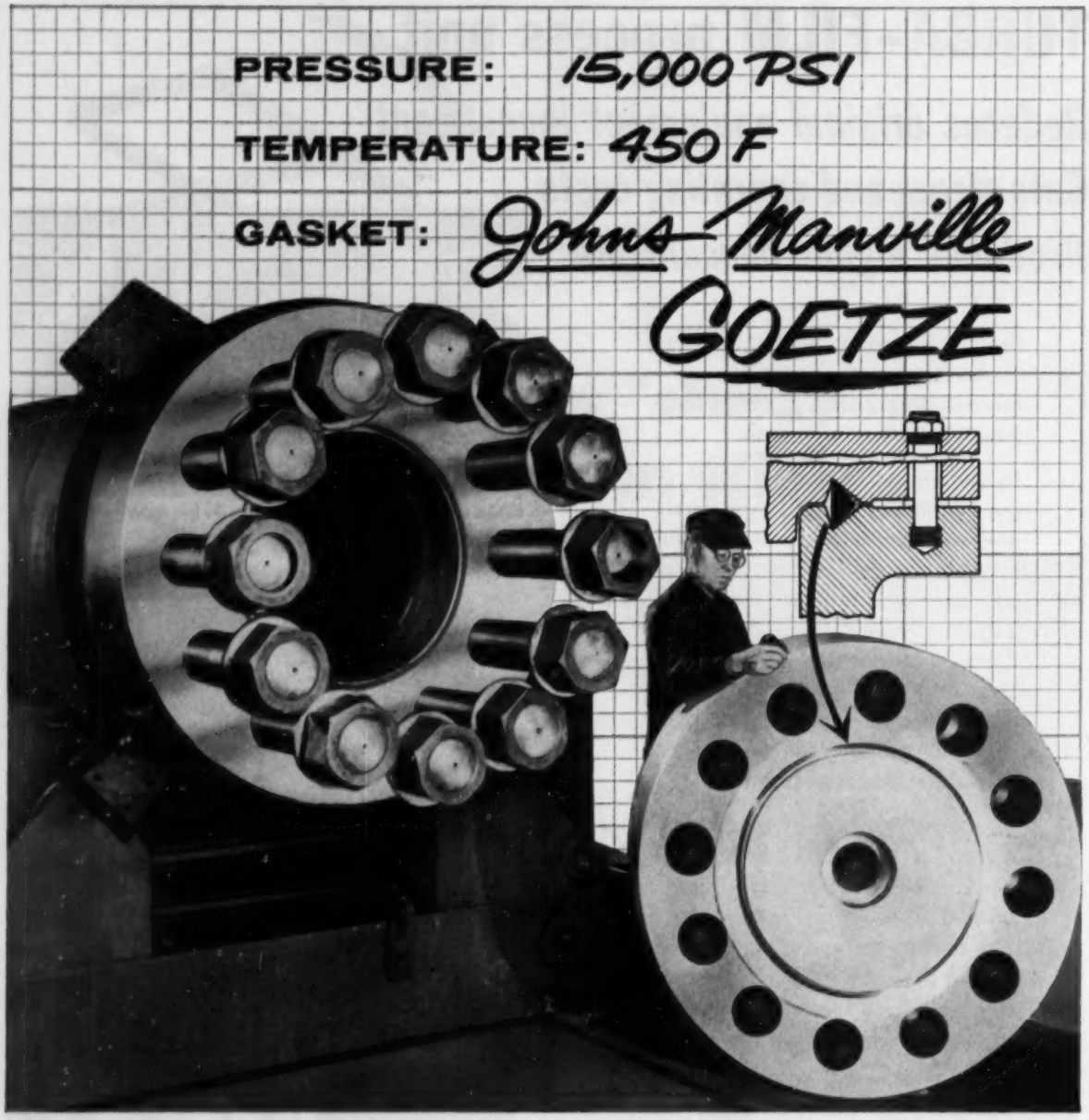
After leaving Tur…-Film unit, gelatin concentrate is pumped to a receiving tank, from which it goes … dryer.

RODNEY HUNT®

RODNEY HUNT MACHINE CO.

Process Equipment Division

31 Vale Street, Orange, Massachusetts, U. S. A.



How A. O. Smith maintains tight seals in giant "Multi-Layer" vessels

Today's tremendous pressures and temperatures have placed special demands on manufacturers of processing equipment. A. O. Smith has answered this need with a special type of "Multi-Layer" vessel construction. And Johns-Manville in turn has provided gaskets that assure tight seals under these exacting conditions. Typical of these is the delta type gasket, illustrated above, which was designed, for this application, to withstand pressures up to 15,000 psi. and temperatures to 500 F.

The development of special gaskets to meet special purposes has been the stock in trade of Johns-Manville's Goetze division for more than sixty-five years. Expert technicians possess a knowledge of metals and other factors related to gasket design and performance that is unmatched in the field. What's more, intensive specialization and modern production tooling provide substantial cost savings on J-M gaskets.

If you need gaskets for high pressure vessels for similar applications, send us a drawing or template for quotation. If you have a sealing problem of any kind, J-M technicians will work directly with your own engineers to develop new gaskets —or adapt existing styles—to meet your specific requirements. Write for further information to Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

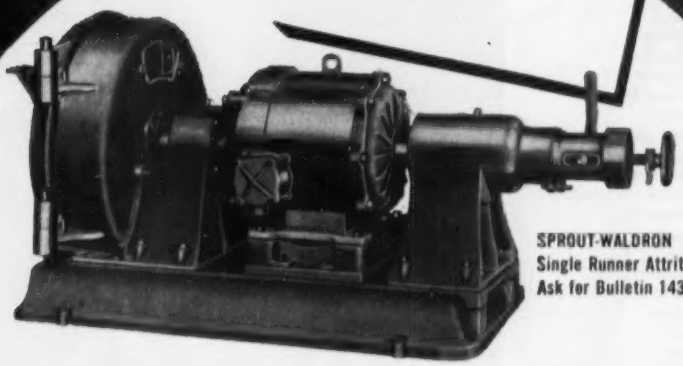
Johns-Manville PACKINGS & GASKETS

Expert engineering guidance on installations and applications

Wide selection of virtually all types of processing equipment

- Facilities and abilities to "adaptioneer" equipment to fit specific needs

100% reliability



SPROUT-WALDRON
Single Runner Attrition Mill
Ask for Bulletin 143

...in grinders, crushers, cutters

You'll find at Sprout-Waldron the **one best** answer to your size reduction problem. Recommendations are completely unbiased because Sprout-Waldron manufactures all types of equipment that reduce materials in size.

Illustrated is probably the industry's most versatile size reduction unit. It rubs, cuts, tears, crushes, grinds, granulates, pulverizes, twists curls, hulls, and blends. Variations in product characteristics are obtainable often times with nothing more complicated than the turning of a handwheel.

In addition, Sprout-Waldron's line of size reduction equipment includes roller mills, hammer mills, burr stone mills, rotary knife cutters, saw tooth crushers, rotary crushers —all in a wide variety of styles and sizes.

Let Sprout-Waldron study your size reduction problem without cost or obligation. If we cannot solve it, you'll be directed to a manufacturer who can. Write for full details.

SW

SPROUT-WALDRON

Manufacturing Engineers Since 1866

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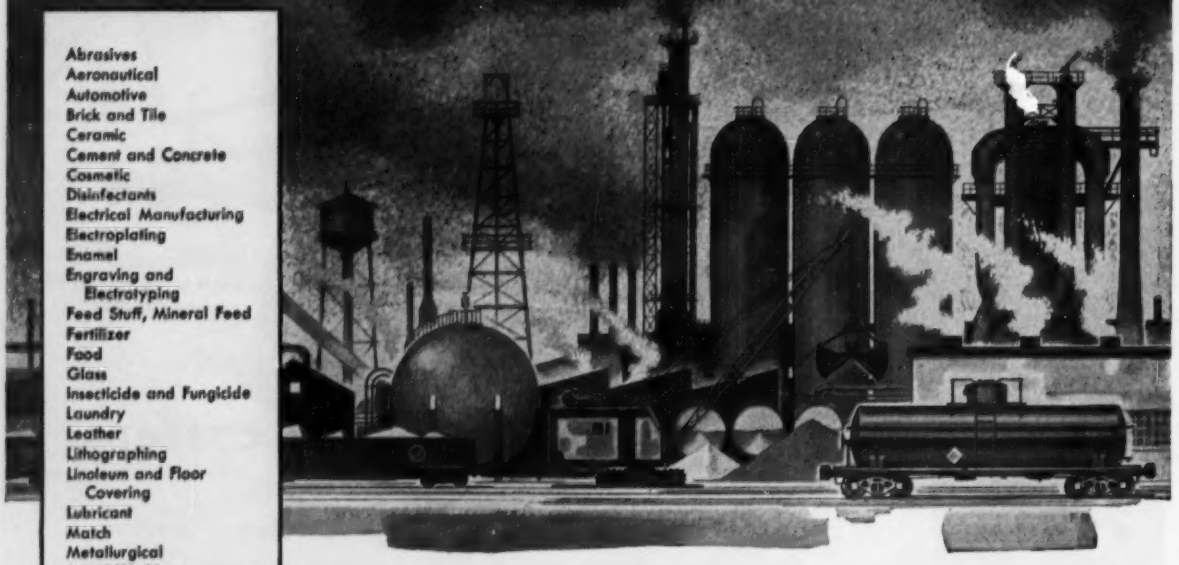

- Abrasives
- Aeronautical
- Automotive
- Brick and Tile
- Ceramic
- Cement and Concrete
- Cosmetic
- Disinfectants
- Electrical Manufacturing
- Electroplating
- Enamel
- Engraving and Electrotyping
- Feed Stuff, Mineral Feed
- Fertilizer
- Food
- Glass
- Insecticide and Fungicide
- Laundry
- Leather
- Lithographing
- Linoleum and Floor Covering
- Lubricant
- Match
- Metallurgical
- Metal Working
- Oil Cloth
- Optical
- Paint, Varnish and Lacquer
- Paper
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Harshaw sells chemicals — thousands of them — for these and many other industries

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GENERAL PURPOSE DIGITAL COMPUTER AND DIGITAL DIFFERENTIAL ANALYZER

ultimate versatility in solving complex technical problems...

The general purpose digital computer solves most scientific and engineering problems with speed and accuracy... yet easier programming makes the digital differential analyzer a superior choice for solving differential equations. Bendix now combines the advantages of both in the *new* G-15D Computer and its optional DDA accessory. Working together, and supported by a full complement of input-output equipment, these units provide the *best* means of solution. And the rental or purchase cost is far below that of most general purpose computers alone.

A new brochure tells the details of the G-15D's talent for conserving your scarce engineering manhours. Let us send you a copy.

Bendix Computer

DIVISION OF BENDIX AVIATION CORPORATION

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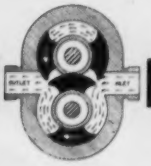
ONLY Waukesha OFFERS ALL 3 IN A PUMP!

1 POSITIVE DISPLACEMENT



...for smooth, even pumping action—no agitation, no pulsation, no areation. Slow speed...positive displacement...no priming.

2 CORROSION-RESISTANT

...manufactured from Waukesha Metal or Stainless Steel —completely corrosion-resistant. Metal will not react chemically with the product or contaminate the flavor.

3 SANITARY

...simple to disassemble, wash, sterilize, and reassemble. The Waukesha O-Ring Seal completely seals out air... completely seals your product in.

...IT PUMPS MANY CORROSIVE SOLUTIONS WITHOUT LEAKAGE

Designed for "tough" pumping jobs in the chemical industry where volatile, corrosive or hot materials of low or high viscosity are being transferred, is the Waukesha positive displacement pump with the spring-loaded John Crane rotary seal. This pump and seal combination minimizes leakage problems.

Waukesha corrosion-resistant pumps are renowned for their precision performance and dependable operation. With positive displacement pumping, you eliminate the turbulence, churning, agitation and aeration so damaging to most products. With smooth product flow you reduce your plant processing problems.

Waukesha has a pump to serve you in the chemical, textile, pharmaceutical, rubber, petroleum and chemical industry.

Complete Line of Pumps

Sizes—Inlet and outlet ports from 1" to 3" dia.

Capacities—1/10 to 100 gal./min.; 20 lbs. to 60,000 lbs./hr.

Head Pressures—Up to 100 psi.

Types—Standard, vented cover, High Boy, V-belt, variable speed, portable.

Typical Products Pumped

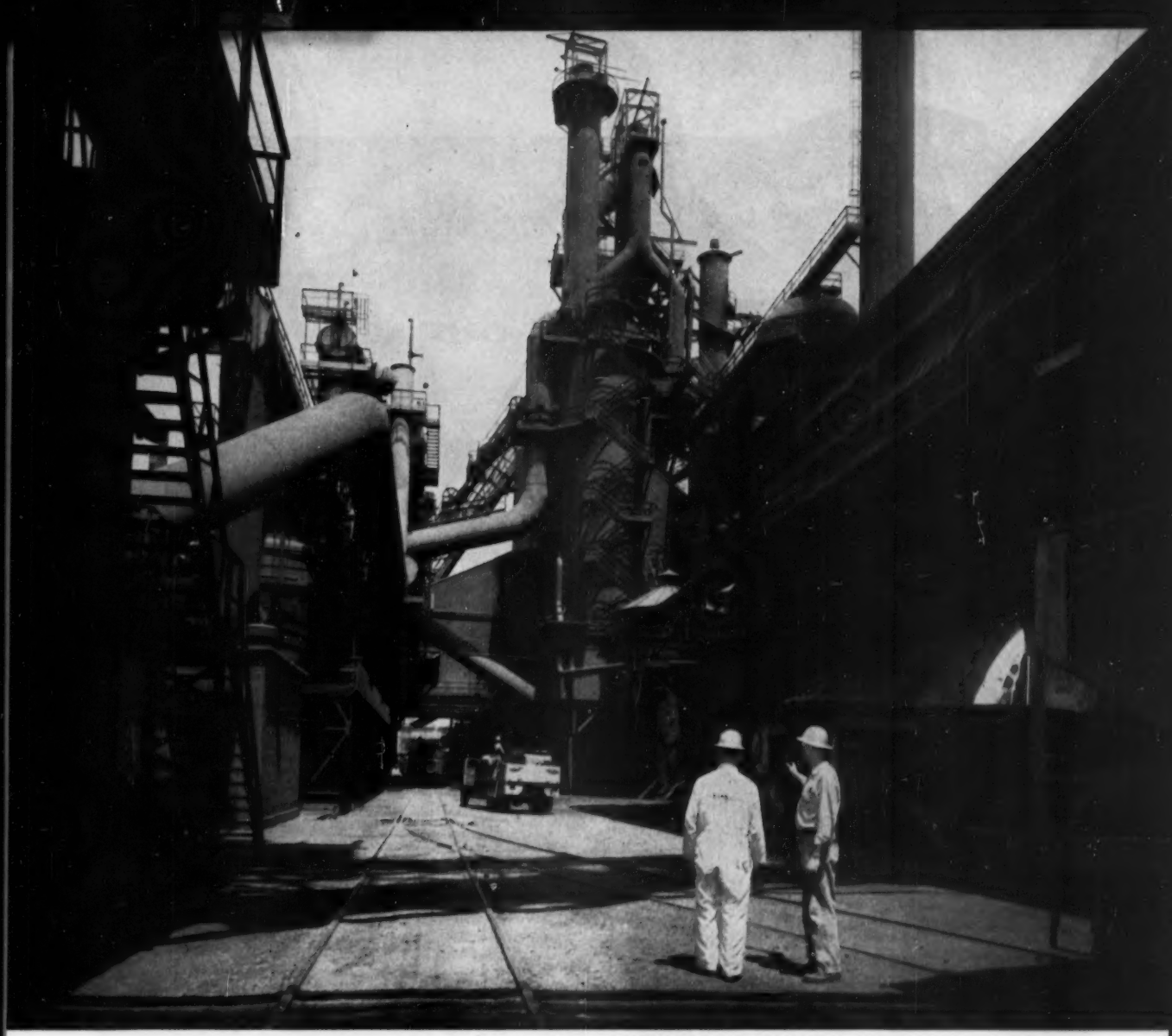
Typical corrosive solutions: acetate solvents, ammonia chloride, aniline dyes, barium chloride, butyric acid, chlorinated water. Also: starch past, alcohol, cold creams, synthetic hormones, cellulose, film dope, ink, lard, paints, syrups.

Write for Complete Pump Information

WAUKESHA FOUNDRY COMPANY, Dept. P, Waukesha, Wisconsin

Waukesha Foundry Company

WAUKESHA—the Forward Look in Pumps. Yesterday, Waukesha Pioneered the Sanitary P.D. Pump. Today, Waukesha Pioneers the Improvements.



CHEMICAL CLEANING AT THE FORD MOTOR COMPANY, RIVER ROUGE, MICHIGAN

Dowell chemical cleaning gets results for Ford

When you have men and costly equipment in your care you don't take chances. That applies to chemical cleaning, too.

You—like Ford—want the company and the men who do your chemical cleaning to fulfill certain requirements. They must be as safety conscious as you are. This has to be your number one requirement.

Next, you want these men to have extensive experience so that you get the best possible job. And you want them to be backed by research facilities, because you know the best possible job can be done only when the latest developments are employed.

These requirements are basic with Dowell, as thousands of companies throughout the country can testify.

You get them and many more when you have Dowell do your chemical cleaning.

Don't take chances. Have your chemical cleaning done by experts. When you want maximum safety and efficiency backed by research in your chemical cleaning—call Dowell. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Dept. J-33.

chemical cleaning service for industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Alumalife® Case

Phenol Case

Why do ASHCROFT DURAGAUGE CASES increase service life?

Duragauge casings add extra-long service life to Duragauges because they're available in three different materials: you can choose the case-material that stands up best in *your application.* You have a choice of *Alumalife*® – a special aluminum alloy; *Cast Iron,* rugged and durable; and *Phenol,* a tough, rigid plastic.

Duragauge casings are dust and moistureproof. Chrome-plated, die-cast retaining rings keep the dial cover glass tightly in position and prevent the entrance of dirt or harmful fumes. Depending upon material, casings are Bonderized and the ring is Anodized and dichromate sealed for protection from corrosion.

For added protection, there is the Maxisafe Duragauge casing with a solid front – a special design for maximum safety and ease of maintenance. Duragauges are easy to service since Duragauge casings are constructed so that the entire system – socket, tube, tip, movement, dial and pointer—can easily be removed as a unit.

Lifetime Duragauge cases are available for numerous dial sizes. You have a choice of Bourdon tube materials, a wide range of pressures, and a movement made completely of stainless steel or stainless steel with nylon bearings and pinion gear.

Whatever case material and gauge system is best for your needs, you can rely on the Ashcroft Duragauge for highest sustained accuracy and long service life.

FOR PROMPT ASSISTANCE in selecting the right Ashcroft Duragauges for your specific needs, depend on the experience of your Industrial Supply Distributor. He is as close as your telephone.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

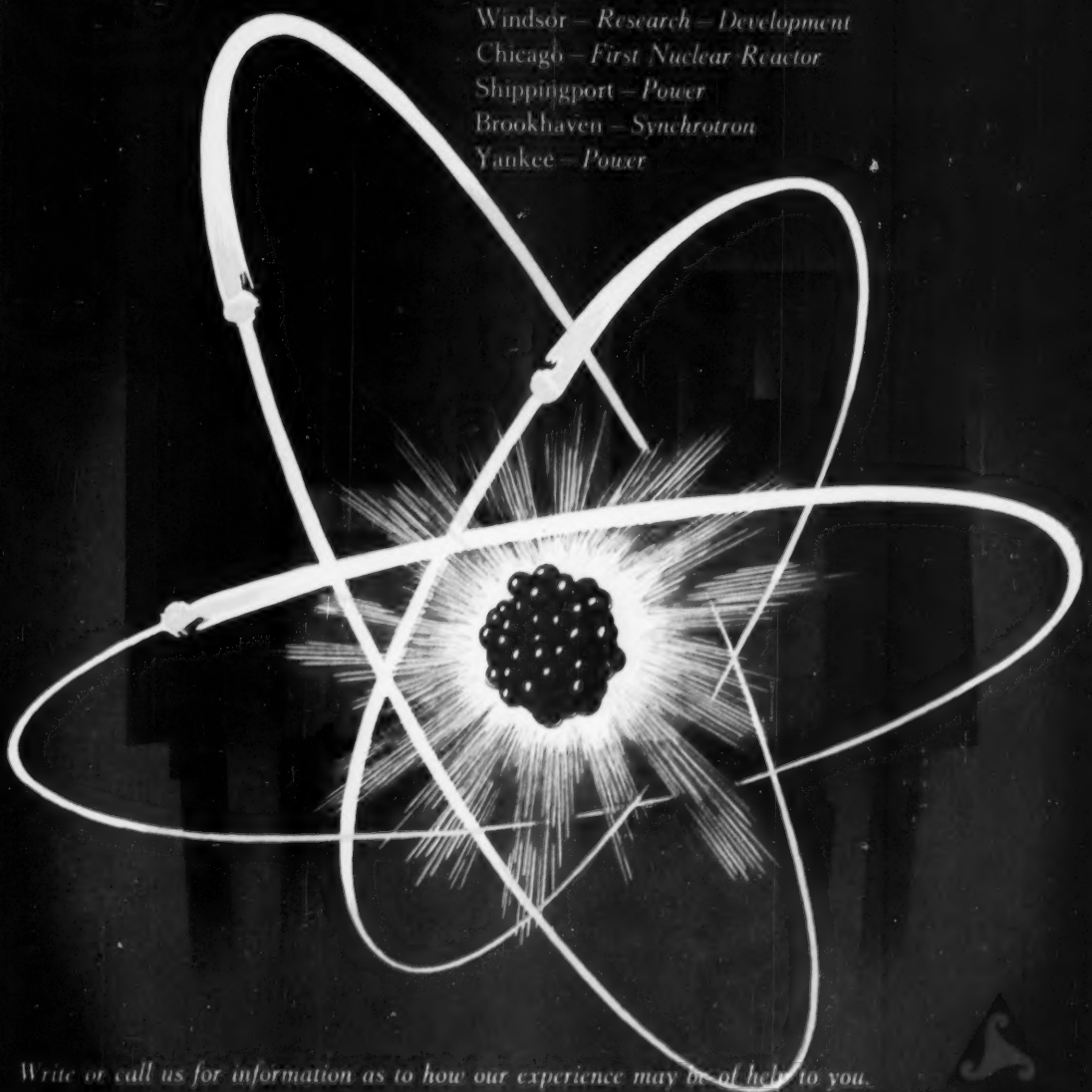
A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

04-56

From the inception of nuclear engineering at Stagg Field, Chicago, to current power and research installations, Stone & Webster Engineering Corporation has been engaged in engineering and construction for nuclear projects.

Trail – *Heavy Water*
Oak Ridge – *U235*
Fort Belvoir – *Power*
Windsor – *Research – Development*
Chicago – *First Nuclear Reactor*
Shippingport – *Power*
Brookhaven – *Synchrotron*
Yankee – *Power*



Write or call us for information as to how our experience may be of help to you.

STONE & WEBSTER ENGINEERING CORPORATION

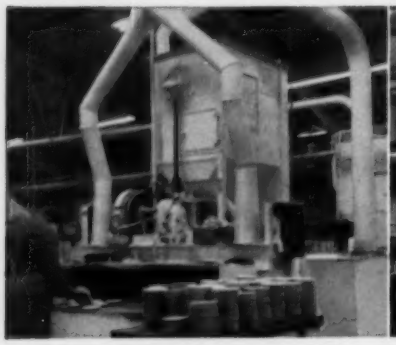
A SUBSIDIARY of STONE & WEBSTER, INC.

New York · Boston · Chicago · Pittsburgh · Houston · San Francisco · Los Angeles · Seattle · Toronto

Lenox China obtains dust-free plant with

WHEELABRATOR® DUSTUBE® COLLECTORS

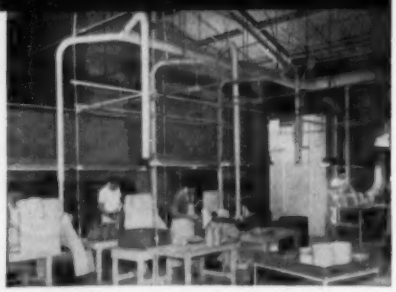
Dust is a constant threat to the creation of fine china, and quality has been the watchword at Lenox, Incorporated, since its founding 70 years ago. When a new plant was built at Pomona, N. J., in 1954, Wheelabrator Dustube Collectors were selected to provide the rigid dust control required. Ten units are used throughout the plant to ventilate mixing, molding, trimming, blasting, grinding and polishing operations. W. N. McGraw, Plant Engineer reports, "The Wheelabrator units have been more than satisfactory."



Wheelabrator Collectors ventilate sandblasting operations performed after firing.

Dust resulting from grinding is vented to the Dustube Collector at far left.

TEN COLLECTORS TRAP DUST AT ITS SOURCE THRUOUT MANUFACTURING PROCESS



Wheelabrator Collectors ventilate the mold making department (top photo) and trimming operations (below).

Dinner service, furnished the White House since the first order by President Wilson in 1917, is included in this display of Lenox China.

For information on how Wheelabrator Dustube Collectors can make your plant dust-free, too, write today for Catalog 372.

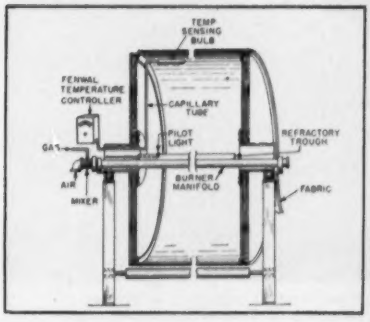
WHEELABRATOR
CORPORATION
347 South Byrkit Street, Mishawaka, Indiana

Controlling A Radiant-Heat Drying Drum

No. 3 in a series — *Showing the Broad Application Range of Fenwal Controls*

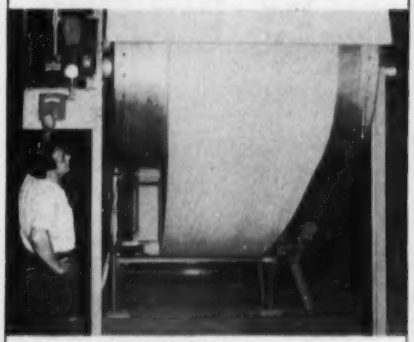
This high-temperature, radiant-heated drying drum is used for drying printed fabrics or for heat-setting synthetic coatings onto fabrics. Particularly interesting is the way in which it combines a Fenwal unit and quick cooling features to secure the close temperature control necessary to prevent scorching the fabric in case of shut-downs.

The drum is usually operated at a surface temperature of 350° to 450°F, but can maintain temperatures up to 700°F, as required. The revolving drum surface is heated by a combination of infra-red rays and convection from a refractory trough heated to incandescence (about 2400°F) by a gas-air manifold burner.



Drum temperature is controlled by a Fenwal Series 540 Indicating Temperature Controller. As shown in the diagram, this is connected by a capillary tube to the temperature-sensing bulb, located close to the interior surface of the drum. The trough and manifold are stationary along the axis of the drum. Flame is played along the surface of the trough by a series of jet nozzles, burning a mixture of air and natural or manufactured gas. To aid in preventing scorching the product, materials used for the drum and heater system are of lowest practical heat capacity. The drum surface is of 16-gauge steel, which assures a low heat content.

Also, the combustion air supply doubles as a coolant for the drum. The air stream is not tied in with the temperature control system and continues to flow after the gas is shut off. Thus, it quickly cools the heater trough and blows the heated air out of the drum. This, plus the low heat capacity of the drum surface, provides the required safeguard against scorching the product during sudden shut-downs.



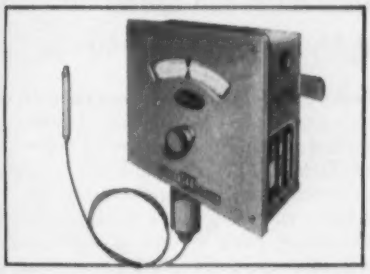
PRECISE TEMPERATURE CONTROL, provided by a Fenwal Series 540 Temperature Indicating Controller (shown at left) is one of the advantages enabling this huge drying drum to set new records for efficiency. In one installation, three 60" diameter drums of this type are drying the same yardage as 20 previously used steam-dryers.

Control Within ¼ of 1%

When the operator sets this Fenwal Series 540 Controller to the required processing temperature, he knows that temperature will be maintained — on the button! Heat input is controlled by the Fenwal unit, actuating a solenoid valve in the supply line. The gas, maintained at atmospheric pressure by a diaphragm regulator, is drawn into a proportioning mixer valve under negative pressure created by the air stream. The air supply, maintained at approximately one psi, reaches the mixer through a separate supply line.

With the Series 540 Control on guard over the heating system, the manufacturer of this advanced drying equipment states that the temperature of the drum surface is maintained within ± one-quarter per cent of the controller scale — outstanding performance for processing equipment of this type.

A Versatile Instrument



The Series 540 Controller is fully adjustable between 100°F and 700°F. Temperature differential is adjustable between 1% and 4% of scale temperature ranges by internal adjustment of pilot contacts. Uniform sensitivity and close accuracy throughout its range are characteristic, making it an ideal temperature indicating controller for kilns, ovens, liquid baths, baking ovens, packaging machinery and general industrial processing.

For Your Own Applications

Investigate the many different types of Fenwal temperature control and detection devices. Besides the Series 540 described here, these include standard THERMOSWITCH® units, Midgets, Miniatures, etc. Send the coupon for new Catalog No. 500. Remember that Fenwal's engineering staff is always ready to help you solve any temperature control problem.

FENWAL INCORPORATED
1610 Pleasant Street
Ashland, Mass.

Please send me your Catalog No. 500. Our specific problem is:.....

.....

.....

Name.....*Title*.....

Address.....

City.....*Zone*...*State*.....

Fenwal CONTROLS TEMPERATURES . . . *PRECISELY*

UNICHROME
Trade Mark

News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

LARGE equipment now easily protected by dipping in plastisol

Steel drum can handle highly corrosive substances

Today's drum lining materials turn ordinary steel containers into containers suitable for chemically active products. With just four basic types of Unichrome linings, corrosion engineers can help solve problems of packaging such things as alkalies, oils, salts and their solutions, wetting agents, acid products, and many other corrosives.

It becomes a matter of matching the service requirements to the chemical and physical properties offered by Unichrome vinyl, phenolic, plastisol, and epoxy drum linings. Bulletin DL-2 gives useful data . . . or Metal & Thermit will gladly give its recommendations.

Neoprene delivers full-bodied film thickness in maintenance coatings

One Ucilon® Coating System based on an air-dry neoprene coating produces a film thickness of 3 mils per coat. Another, requiring force drying, provides a film of 5 mils or more per coat.

Such thicknesses, added to the well known resistance of neoprene to corrosives and oils, assure durable protection under severe service conditions. Send for data sheets.

UNICHROME is a trademark of Metal & Thermit Corp.

METAL & THERMIT
CORPORATION
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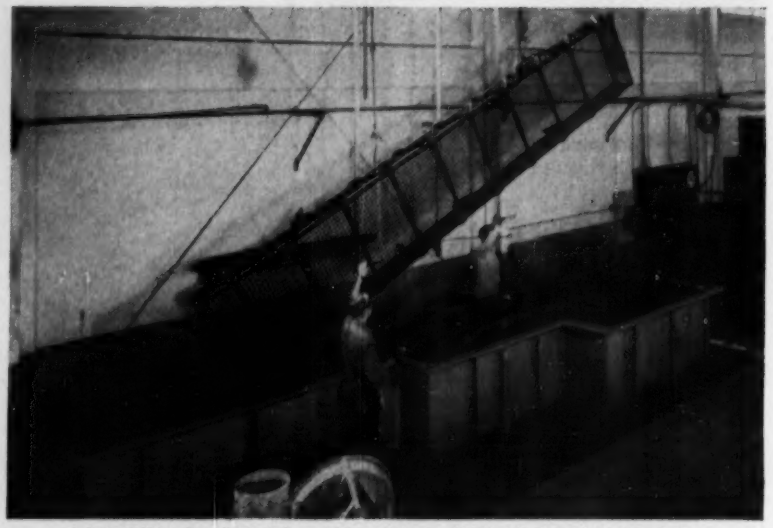
Pittsburgh • Atlanta • Detroit
East Chicago • Los Angeles
In Canada: Metal & Thermit—United Chromium of Canada, Limited, Toronto 1, Ont.



A huge 4,000 gallon dip tank for applying Unichrome Plastisol Coatings is in the plant of The Barber-Webb Co., Los Angeles. It has three widths, to accommodate various shapes.

PLASTISOL coatings grow more popular with each passing month. The more familiar that users become with the unusual corrosion protection and durability of these flexible, heavy duty vinyl coatings, the more new applications are developed.

Plants are therefore enlarging facilities to handle bigger and bigger equipment and products by *dipping* . . . the quickest and easiest method. Unichrome Series 4000 Plastisol Compounds are widely used to fill these tanks.

CORROSION BLOCKED

Unichrome Plastisols protect against acids, alkalies, alcohols, salt solutions, moisture, and a broad range of other chemically active compounds. When coated with a Unichrome Plastisol, ordinary metal parts and products are equipped to survive unusually severe service conditions.

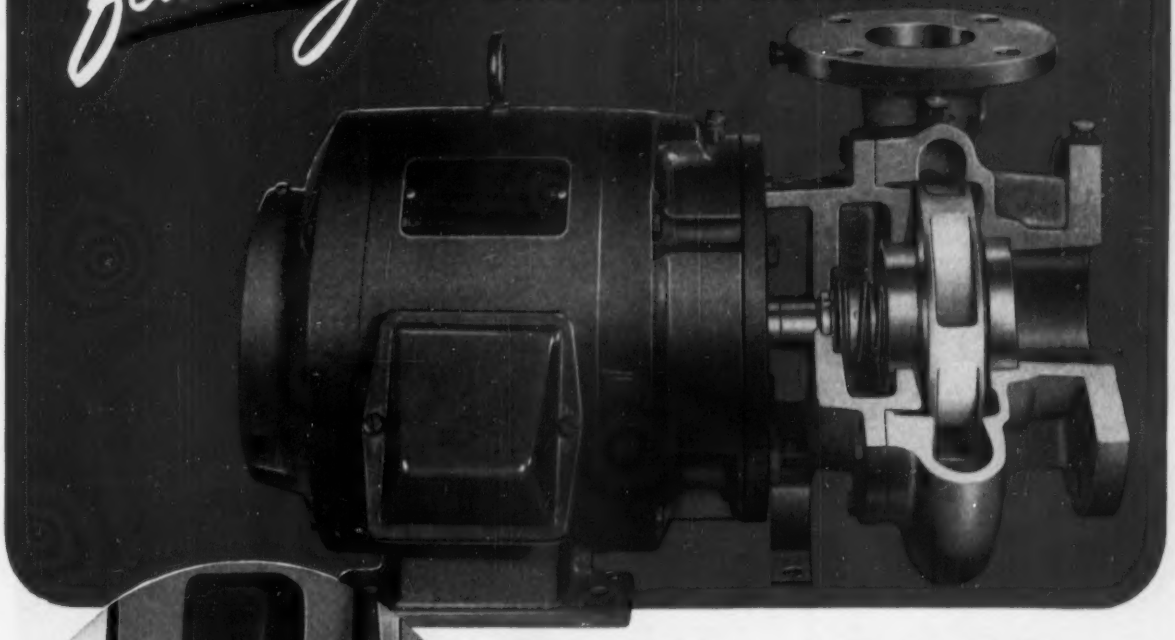
UNIQUE PHYSICAL FEATURES

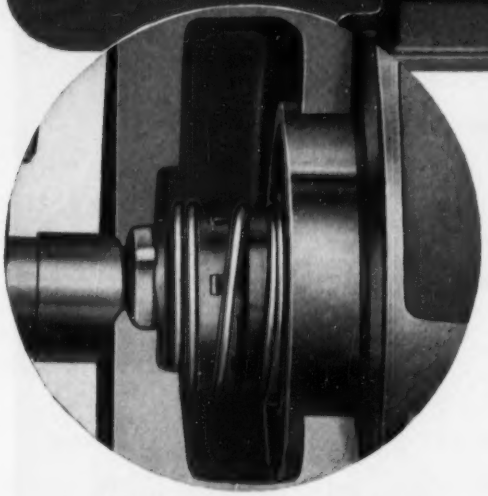
Unichrome Series 4000 Plastisol Compounds cure to flexible coatings which show great resistance to wear. They don't chip. They absorb impact, deaden sound, insulate electrically, and also look attractive. Depending upon the mass of the object being coated, they build a film thickness ranging from 3 mils to $\frac{3}{16}$". Heavier masses hold more heat and therefore get thicker coatings in dipping.

Unichrome Plastisols can be applied by all the other usual methods, too, including *spraying*. They're limited only by the facilities available to heat and hold the coated object at 350° to 365°F for curing. Send for Bulletin VP-1.

featuring...

VERTICAL SPLIT-CASE DESIGN
LEAK-PROOF MECHANICAL SEAL
LATEST "NEMA" MOTORS





Leak-proof B&G "Remite" Mechanical Seal

B&G SERIES 1531 TYPE B
CENTRIFUGAL PUMP

In the B&G 1531 Pump you'll find an impressive array of efficiency and performance features which will satisfy your most critical appraisal—

The Motor. Heavy duty with extra large shaft and over-sized bearings. Deep grooved radial thrust bearing counter-balances thrust load. Available *as open, splash-proof, totally enclosed or explosion-proof units.*

Motor Pump Bracket. Barrel type for maximum rigidity...counter-bored for perfect alignment. Support foot protects against vibration and strain.

Pump Shaft. High grade steel, super-finished for smooth, quiet operation and long life...oversized for minimum deflection. Gasketed sleeve protects against wear and corrosion.

B&G "Remite" Mechanical Seal. Eliminates leakage which occurs when a packing gland is used. A Carbon Seal Ring faces on a "Remite" floating seat—*a new material just a shade under a diamond in hardness*—gives trouble-free service when pumping liquid containing foreign material. The Seal is self-lubricating.

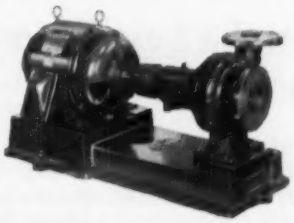
One piece volute and suction cover. Solid based with support foot. All the advantages of split-case design—no pipes to disconnect when servicing the pump. Rugged construction absorbs piping strains without transmitting stress to the motor shaft.

Impeller. Sound hydraulic design, mechanically balanced. Balance ring and relief holes reduce thrust. Precision fit on shaft assures easy removal and positive centering.

Capacities and materials. To 1100 GPM—420 ft. head. Available in all-bronze, all-iron and bronze-fitted units.

SERIES 1510 TYPE B CENTRIFUGAL PUMPS

Vertical split case construction, featuring balanced loading of impeller and bearings. Handles loads far in excess of those produced by any pump and motor combination. Easily serviced without breaking pipe connections.

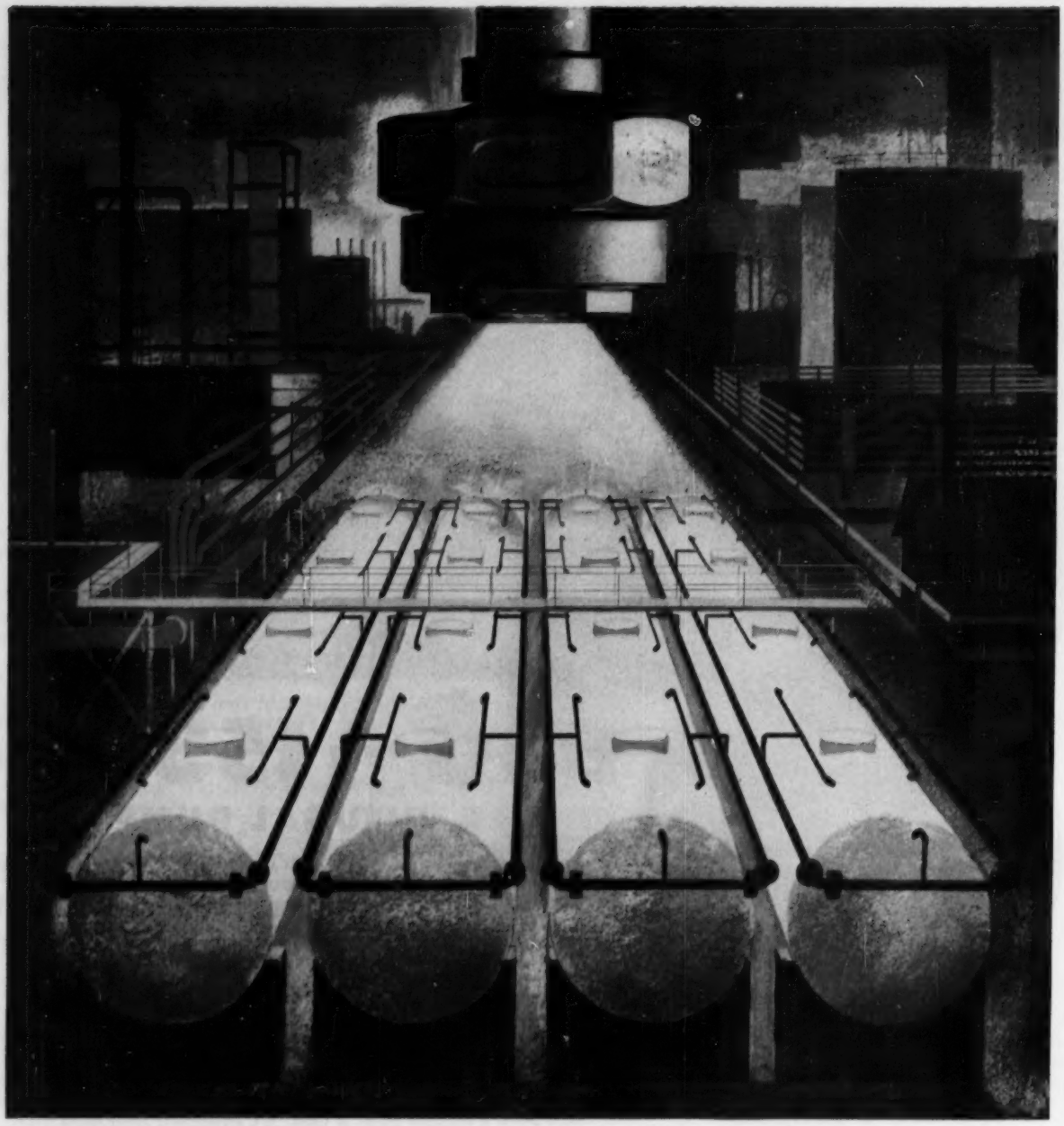


HEAT EXCHANGERS

A complete line for water heating, process work, air conditioning and refrigeration. Send for literature.

BELL & GOSSETT
COMPANY
Dept. EN-11, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, W. Toronto, Canada



give your plant and equipment the best fire protection— a BLAW-KNOX automatic fog system

BLAW-KNOX Automatic Fire Protection Systems are engineered to provide positive protection for your plant and processing, storage, and other equipment. If a fire breaks out, the system goes into action immediately:

- **alarms sound**
- **fire smothered *promptly***
- **heat dissipated by *cooling* action**
- **pressure build-up prevented**

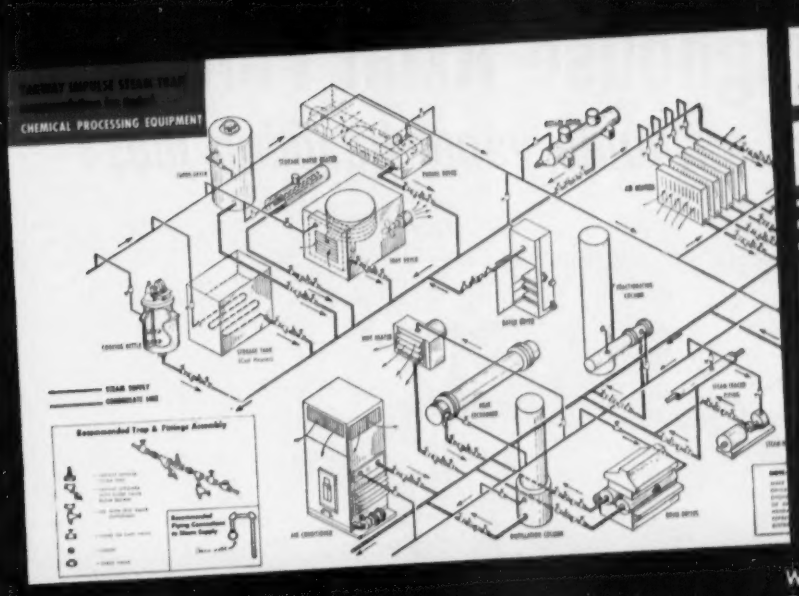
Why not give your plant and equipment the BEST possible protection. Let a Blaw-Knox *fire-protection* Engineer study your needs. He will gladly submit a layout and a cost estimate . . . with no obligation to you.

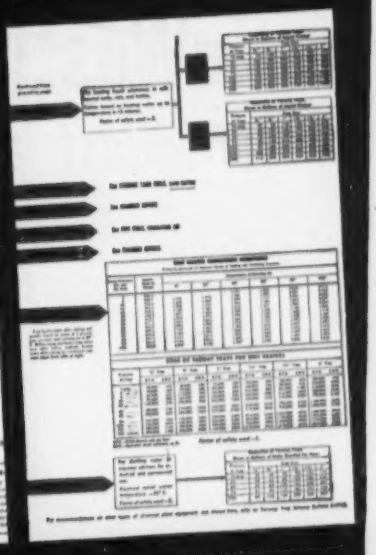
"Little Joey Sprinkler always on the job"

50th Anniversary BLAW-KNOX 1906-1956

BLAW-KNOX COMPANY
Automatic Sprinkler Department
Pittsburgh 33, Pennsylvania

HOW TO TRAP CHEMICAL PROCESSING EQUIPMENT—*PROFITABLY*





Write for your free large scale Chemical Piping Diagram and Steam Trap Selector.

"This Yarway Piping Diagram and Steam Trap Selector is a real big help to us."

When it comes to picking the right steam trap for the right job, this YARWAY bulletin is invaluable.

Piping diagrams for trapping 22 typical kinds of process equipment are shown—and selector tables covering 35 types of equipment.

The selector will guide you in *choosing* the correct steam trap, and the piping diagrams will show you the proper *installation*.

On all your steam trap requirements, the way to be sure of successful *performance* is to use YARWAY IMPULSE STEAM TRAPS—the impulse that revolutionized steam trapping 20 years ago and has sold over a million traps since.

Write for your FREE copy of this YARWAY Piping Diagram and Selector for Chemical Processing Equipment, or get one from the local YARWAY Industrial Distributor—over 270 cover the country.

YARNALL-WARING COMPANY
137 Mermaid Avenue, Philadelphia 18, Penna.

Yarway Impulse Steam Trap. Gets equipment hot in a hurry and keeps it hot! Stainless Steel. Good for all pressures. Only one moving part.

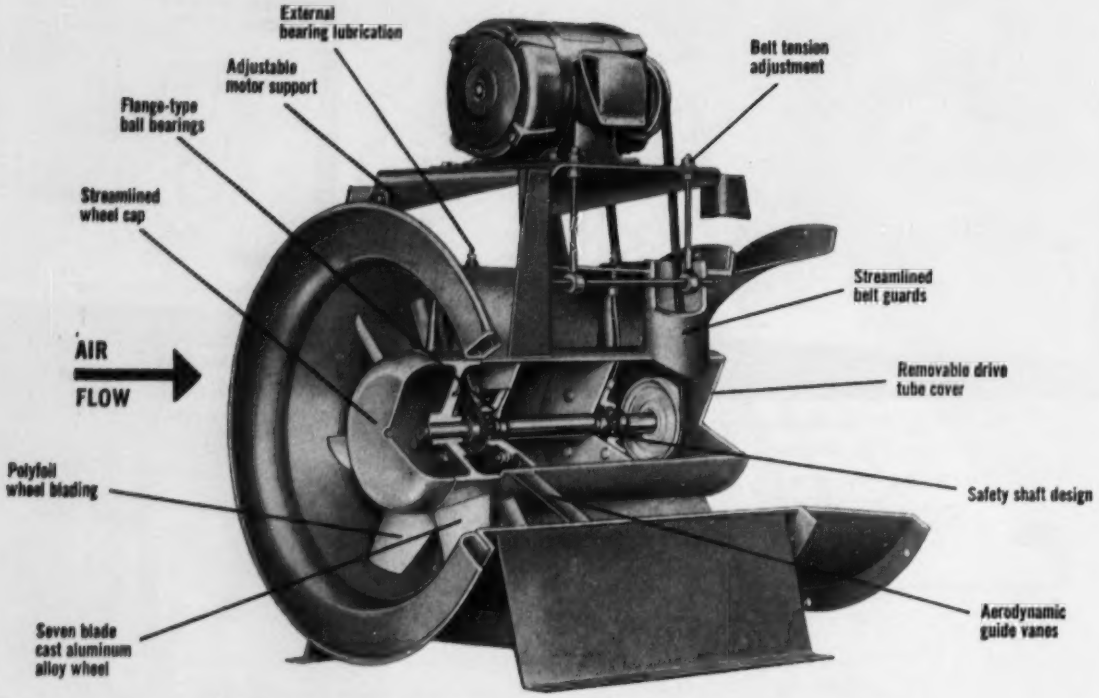
YARWAY

IMPULSE® STEAM TRAP

The Impulse that revolutionized steam trapping 20 years ago.

NEW Improved Westinghouse Axial Flow Fans

for Industrial air, fume, vapor handling jobs!



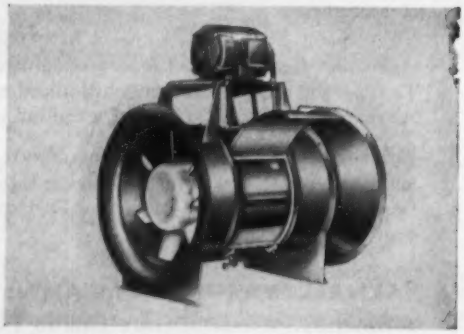
CUTAWAY VIEW OF WESTINGHOUSE AXIFLO® VANEAXIAL FAN FOR GENERAL APPLICATION.

COMPLETE NEW LINE

With: volumes from 1,700 to 100,000 CFM—static pressures up to 3¼"—14 sizes, Vaneaxial or Tube Axial, direct-connected or V-belt driven, with wheel diameters from 15" to 72".

- **Space Saving** . . . compact Axial Flow design permits installation directly into duct work.
- **Improved performance** . . . non-overloading horsepower feature permits use of smaller motors.
- **Least maintenance** . . . rugged practical construction insures continuous trouble-free operation.

For complete application service, call your nearest Sturtevant Sales Engineer, or write Westinghouse Electric Corporation, Sturtevant Division, Dept. 13K, Hyde Park, Boston 36, Mass.



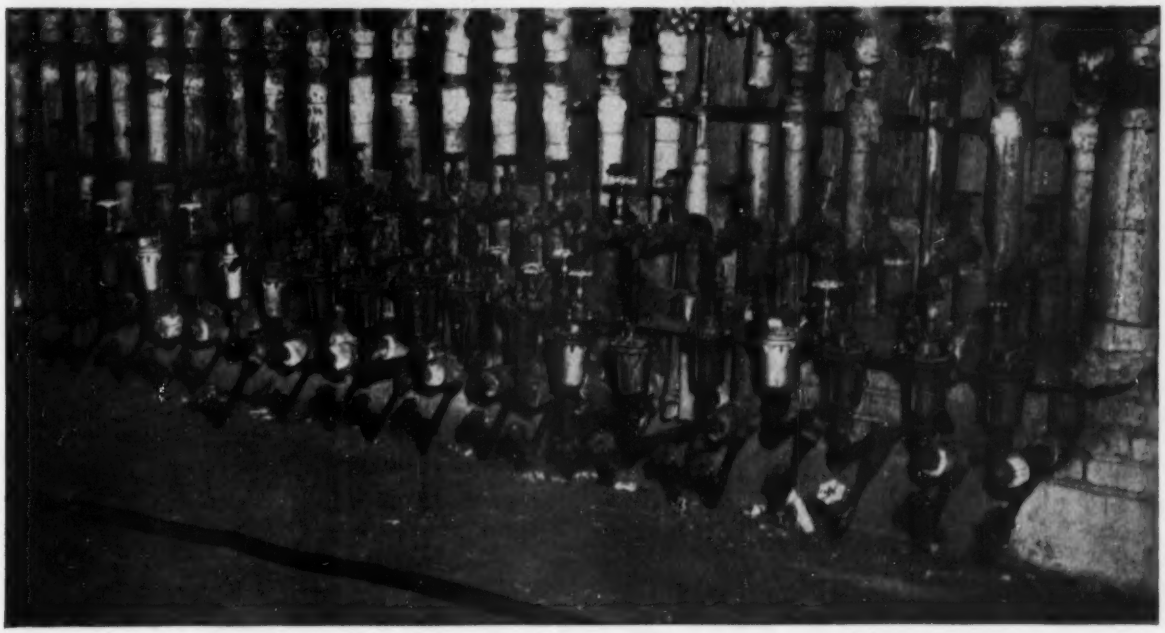
Spray booth Vaneaxial Fan specially designed to provide easy access required for paint spray exhaust!

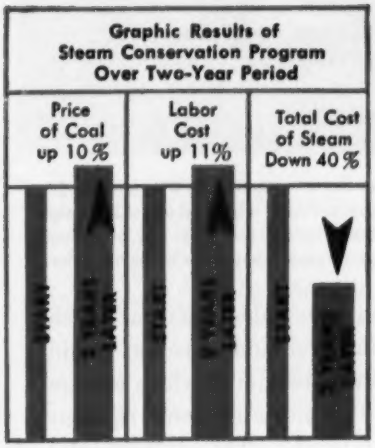
WATCH WESTINGHOUSE!

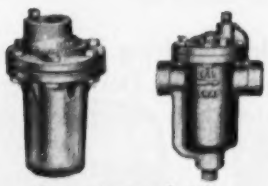
J-80592AA

COVER PRESIDENTIAL CAMPAIGNS ON CBS TELEVISION AND RADIO

How a Major Chemical Company Cut Steam Costs $100,000 Annually




Graphic Results of
Steam Conservation Program
Over Two-Year Period
Price of Coal up 10%
Labor Cost up 11%
Total Cost of Steam Down 40%



Trap sizes and styles
for every condensate drainage job.

Armstrong Traps were a "Major Factor" in Steam Conservation Says Chief Engineer

Steam waste has a way of creeping up on you. Especially in older plants. The losses can make a staggering total.

Plants looking for a way to fight rising costs can well take a page from the 8-point steam conservation program that netted a major chemical plant $100,000 annual saving:

1. **Waste steam utilized** — all flash steam recovered for building heating.
2. **New steam traps installed** — Armstrong traps replaced old traps throughout the plant, indoors and out.
3. **Steam leaks repaired.**
4. **Insulation repaired.**
5. **All condensate recovered.**
6. **Steam piping simplified.**
7. **Steam turned off when not needed.**
8. **Preventive maintenance improved** to insure a continuous checkup on sources of waste.

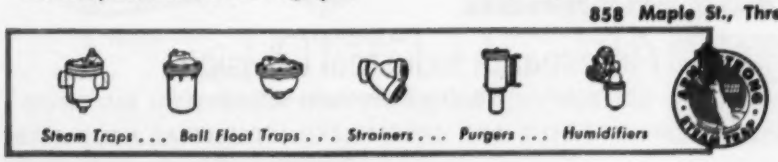
In commenting on the program, the Chief Engineer of the plant stated, "*4000 new Armstrong steam traps were one of the major factors in conserving steam. The traps, plus improved installation practice, have reduced annual trap maintenance parts and labor by $25,000 as compared to traps previously used.*"

Want all the facts? Tips on cost-saving standardized trap hookups? Facts about Armstrong traps? Ask for:

1. The No. 1, 1956 issue of the Armstrong Trap Magazine containing complete details, drawings and photos.
2. The 44-page Armstrong Steam Trap Book, a fact-full guide to better trapping.

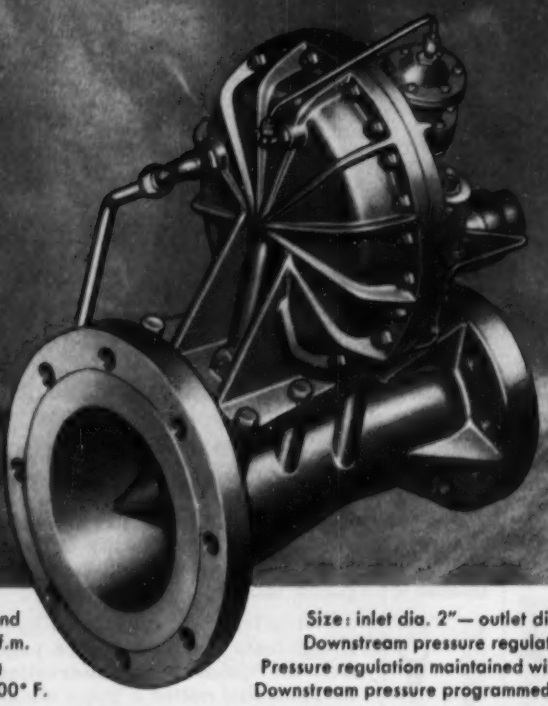
Call your local Armstrong Representative or write:

ARMSTRONG MACHINE WORKS
858 Maple St., Three Rivers, Michigan



ARMSTRONG STEAM TRAPS

THIS VALVE SOLVED A SPECIAL PROBLEM



SPECIFICATIONS . . . Closing time: 0.1 second
Volume flow: over 40,000 s.c.f.m.
Inlet pressure: over 3,000 psig
Temp. range: +400° F. to −300° F.

Size: inlet dia. 2"— outlet dia. 8"— length 18"
Downstream pressure regulated up to 300 psig
Pressure regulation maintained within 1% of setting
Downstream pressure programmed with timing motor

Fifteen years of AiResearch experience in engineering and fabrication of valves for special applications went into this design.

As you can see from its specifications, the valve shown does a job that has never been done before. This type of valve problem is increasing, particularly in petroleum, chemical, rocketry, atomic energy and research applications.

AiResearch has designed and manufactured thousands of valves to meet special requirements. We are prepared to solve valve problems which include the handling of liquid nitrogen, liquid oxygen and pressurized helium . . . which require operation without fail under the most rigorous extremes of heat, cold and other environmental conditions.

If you have a problem involving specialized valves, we invite you to contact us. Our engineers will analyze your problem with you and recommend a solution.

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Boulevard, Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

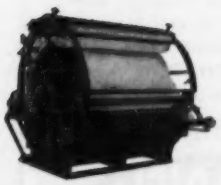
The Mark of *Better Filtration*

Tear a small piece from the continuous sheet of cake coming from a FEinc String Filter. Turn it over in your hand. In the closely spaced grooves you'll see why FEinc gives better filtration . . . on jobs ranging from thick fibrous cakes to thin sticky slimes.

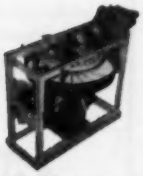
The strings literally lift the cake out of the weave of the cloth. No scraper to wear, smear or plug the fabric. The cake is dryer, too. Cleaner cloth aids filtrate removal, with less vacuum. No "blow-back" is needed to loosen the cake, hence no filtrate is blown back into the cake. If FEinc's Compression Dewatering Mechanism is added, you get 2 to 6% more moisture out of the cake.

It all adds up to higher yield with FEinc: Cleaner, more workable cake . . . higher recovery of solubles . . . higher filtration rates with a smaller filter . . . extra savings in reduced "down-time" and longer cloth life.

The Original String Discharge Filter is now only one of many types of FEinc continuous rotary vacuum filters available . . . custom-made at standard costs. Write for bulletins today, or ask for performance studies. No obligation, of course.



STRING



HORIZONTAL

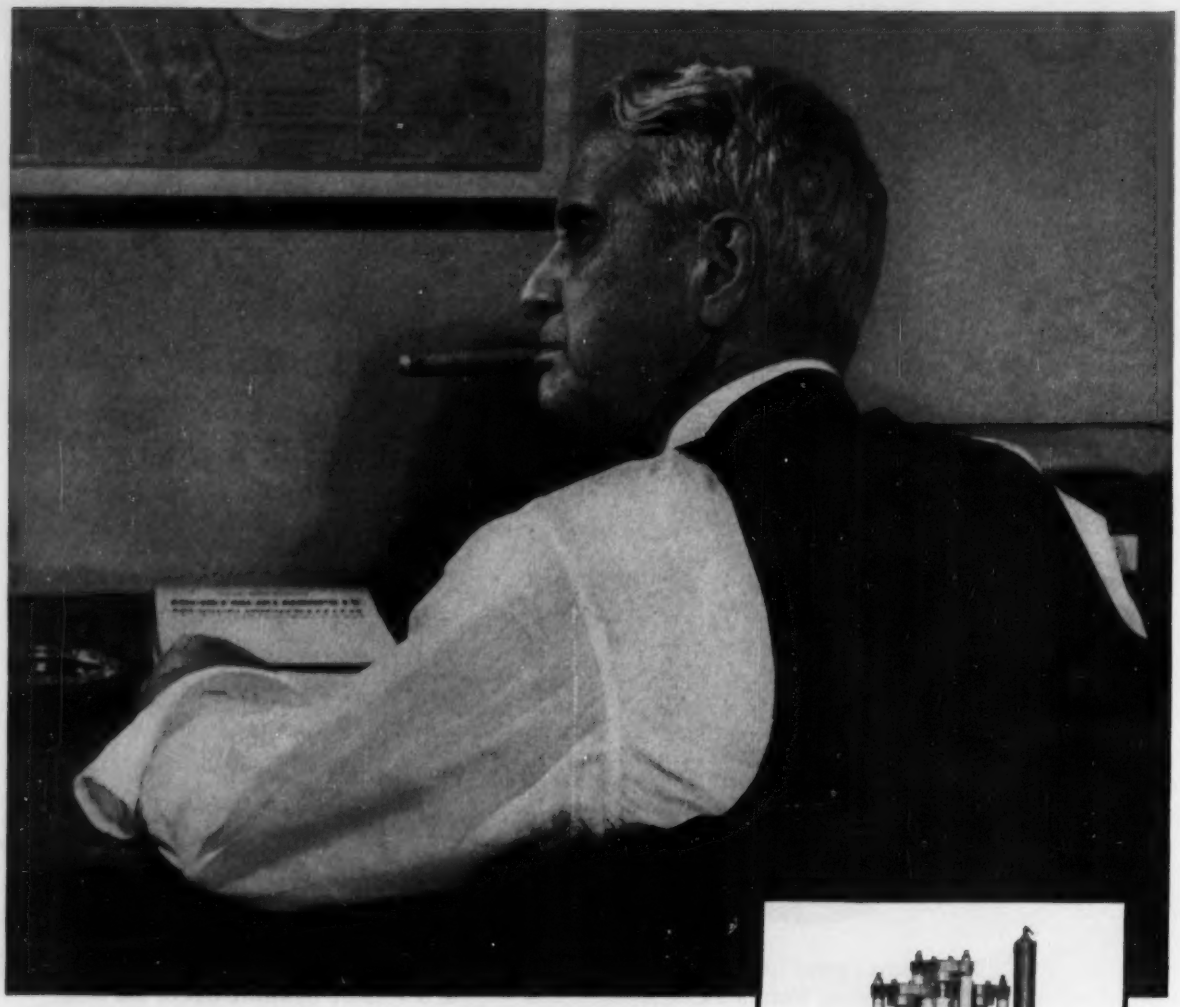
SCRAPER

CUSTOM DESIGNED CONTINUOUS FILTRATION

48

FEinc *For a Bigger Yield*

FILTRATION ENGINEERS, INC.
155 Oraton Street, Newark 4, N. J.

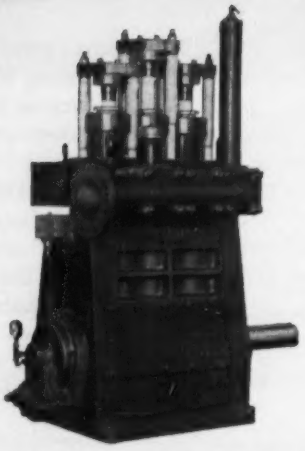


"And I say it has to be an ALDRICH PUMP!"

Corrosion, abrasion, high viscosity, high pressures . . . overcoming these problems has given Aldrich the reputation for building pumps that do the "impossible". The tougher the job . . . the more important it becomes to take advantage of our wide experience in building pumps for the chemical industry.

On the less critical jobs, too . . . it makes sense to call Aldrich. The simplicity of the Aldrich Direct Flow design, with fluid-end sectionalization, offers substantial economies in both operation and maintenance. Fluid-end designs are available in aluminum bronze, stainless steel, Hastelloy and titanium.

A copy of our new condensed catalog showing the line of Aldrich Pumps, is yours for the asking. Write today for Data Sheet 100. The Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.



Aldrich Direct Flow Pumps are especially well suited to chemical service. The complete Aldrich line includes Triplex, Quintuplex, Septuplex and Nonuplex Pumps, 25 to 2400 hp.

THE ALDRICH PUMP COMPANY

AL CHROMIUM-MANGANESE LOW-NICKEL STAINLESS GRADES

Here is a direct answer to the recurring problem of nickel shortage. For many users of chromium-nickel austenitic stainless steels, the new AISI 200-series of chromium-manganese low-nickel austenitic grades can be a source of immediate relief—and an avenue to the reduction and possible avoidance of nickel shortage problems in the future.

In many cases, you can switch directly from the older Type 301 and 302 grades to the new AL Stainless Type 201 and 202 steels, using the same fabricating processes and securing about the same results. There's nothing new to learn, and no loss in performance in practically all applications. In certain respects, these steels have better properties than the older materials and may be used to actual advantage in some cases.

We also produce low carbon grades of these chrome-manganese steels, arbitrarily designated Types 204 and 204L (similar to the older grades 304 and 304L) . . . as well as a lower-chromium, higher-manganese grade designated Type CM, which contains only 1% nickel. Allegheny Ludlum has pioneered in the development and application of these low-nickel stainless steels. We know what the new grades will do . . . let us help you put them to use. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

WRITE FOR THE ASSISTANCE YOU NEED

1. "TECHNICAL STUDIES #3"

. . . essential information on the composition, properties, fabricating methods and applications of AL chromium-manganese, low-nickel stainless steels. *Write for your copy.*

2. TEST SAMPLES

. . . We'll be glad to supply engineering assistance, and actual samples of these 200-Series steels for testing under your processes and conditions.

ADDRESS DEPT. CE-82

For Stainless Steel in ALL Forms—call

Allegheny Ludlum

AL STAINLESS STEEL

WSW 8758

Warehouse stocks carried by all Ryerson Steel plants

FOR SALE—as a Unit
COMPLETE INDUSTRIAL PLANT
STRATEGICALLY LOCATED IN OMAHA, NEBRASKA

INVESTIGATE—THIS PLANT OF MANY USES

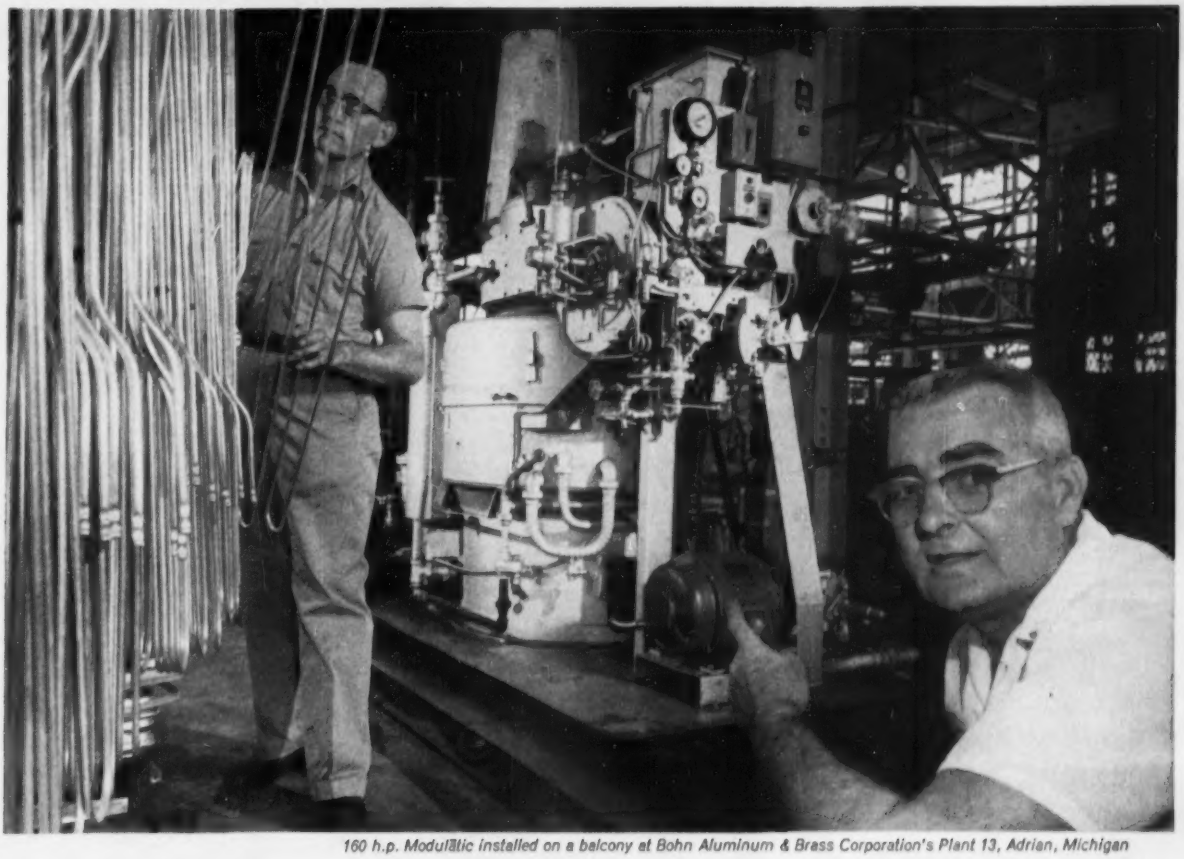
Includes 6½ acres of land, buildings, machinery and wide variety of industrial equipment potentially useful for manufacture of anti-biotics, biological, pharmaceutical, food and feed products. Plant is still fully equipped with functional units primarily for production of commercial grade ethyl alcohol and resultant by-products. Five minutes from downtown, has railroad sidings and dock facilities. Nine wells and well-sites supply the plant with fresh water and a year-round temperature of 50-52 degrees. In addition, both city and Missouri River water are available. Plant buildings shown within dotted white lines on photo. Personal inspection may be arranged by contacting address below, or Room 104, Federal Office Building, 15th and Dodge, Omaha, Nebraska—Telephone: Jackson 7900.

Sale by sealed bid.

Bids will be received at address below until 2:00 p.m., C.S.T., October 30, 1956, when they will be opened and read.

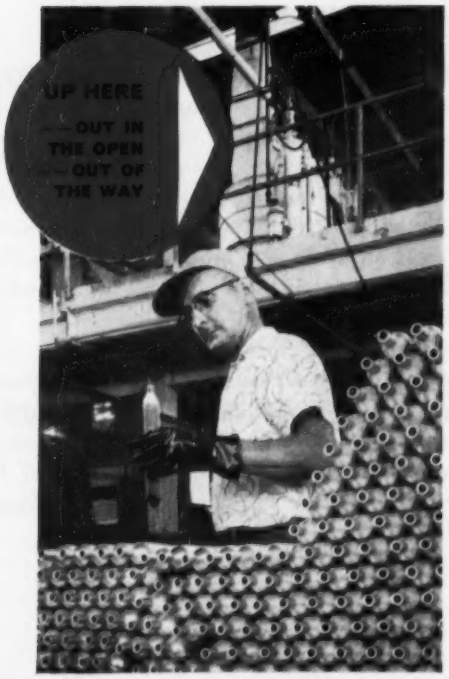
Information, bid forms, and instructions for bidding may be obtained from:

GENERAL SERVICES ADMINISTRATION
ROOM A
2306 EAST BANNISTER ROAD • KANSAS CITY, 14, MISSOURI



160 h.p. Modulātic installed on a balcony at Bohn Aluminum & Brass Corporation's Plant 13, Adrian, Michigan

MODULĀTIC steam generators solve space problems!



In Canada, write Vapor Car Heating Co. of Canada Ltd., 65 Dalhousie St., Montreal 3, Que.

Front row, balcony, center! It's the "best seat in the house" for this Modulātic steam generator. *Best* . . . because it conserves critical manufacturing area—because, here, it pipes-in with Bohn's other Modulātic—because these two efficient "go anywhere" units make production-steam right where it's used.

How about you! If you need steam for heating, power, or processing, get complete information on the self-contained, push-button Modulātic. It's the world's most compact power-package—takes no more room than a desk and chair.

You have the choice of oil, gas, or combination burner—of eight sizes to 160 h.p.—of pressure from 2 to 285 p.s.i. (or much more, if needed). Over 13,000 already in use.

VAPOR HEATING CORPORATION
80 E. Jackson Blvd., Chicago 4, Ill., Dept. I-4

Please send me free 12-page Modulātic Booklet No. 586.

Name_____ Title_____

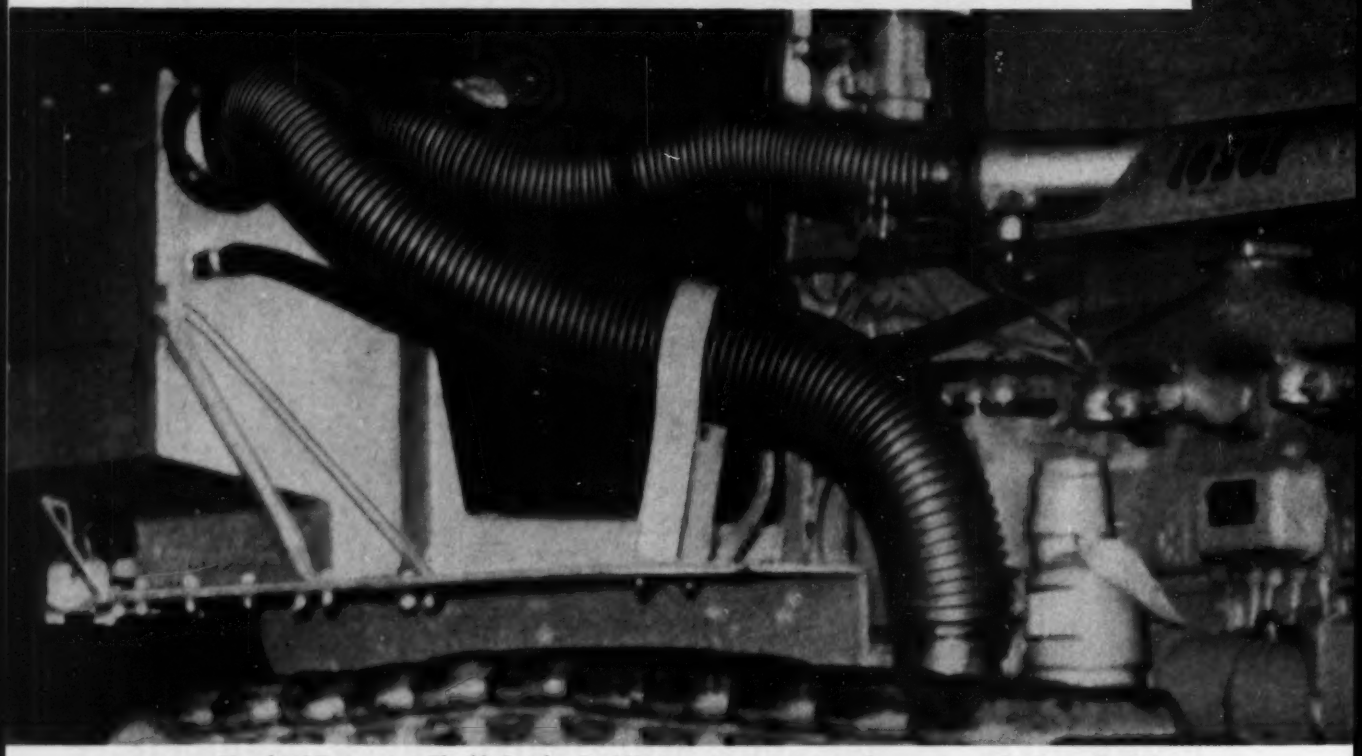
Company_____

Street_____

City_____ Zone_____ State_____

Where you convey gases

and have problems of vibration, misalignment, moving parts or cramped spaces



3" and 4" I.D. American Flexible Stainless Steel Hoses used to convey hot exhaust gases on this Caterpillar D2 Diesel Tractor, equipped with Exhaust Conditioner, used in underground, hard-rock mining operations.

Get more service hours per dollar with American Flexible Metal Hose

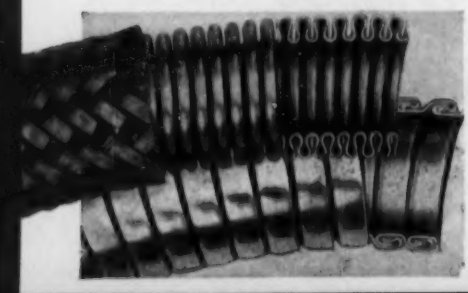
Famous quality construction of American Flexible Metal Hose offers you the security of trouble-free, leak-proof service in conveying gases, whatever your needs. Proof of this is American's enviable record—in thousands of applications—for the pressure-tight conveyance of air, oxygen, hydrogen, nitrogen, acetylene, propane, butane, Freon, ammonia, and many other gases under both high and low pressures.

And—because of its flexibility—American Flexible Metal Hose absorbs vibration and prevents its transmission into surrounding structures . . . travels with expansion and contraction due to temperature changes . . . facilitates installation, particularly in cramped spaces . . . solves problems of misalignment and moving parts.

Available in a wide range of diameters in tough, corrosion-resistant bronze, steel, supernickel, brass, stainless steel or other metals, American Flexible Metal Hose delivers the very highest *service hours per dollar*. You can order complete assemblies with end fittings attached—made to your specifications and ready for immediate installation.

Before your next design job, call your nearby American Metal Hose representatives for engineering help. Their suggestions will help you solve and save on connector problems. The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Limited.

86379



BASIC TYPES

Seamless corrugated and Strip-wound. Both types available in a wide range of sizes and styles in any workable metal. Furnished with or without end fittings attached.

WHEREVER CONNECTORS MUST MOVE

AMERICAN FLEXIBLE METAL HOSE AND TUBING

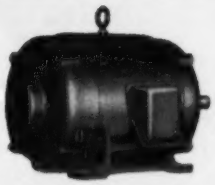
AN **ANACONDA**® PRODUCT

for full operating efficiency

choose a Century MOTOR

***Performance-Rated* to Bring Out All the Top Performance That's Engineered Into Your Equipment**

DRIP PROOF—1/20 to 3/4 H.P.
A.C., Single or Polyphase
Send for Bulletin 1-5P1

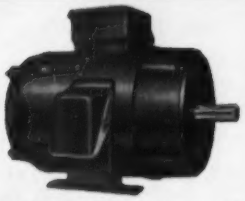


RIGID BASE, OPEN TYPE, PROTECTED
1 to 400 H.P.—A.C., Single or Polyphase
May be used in place of splash proof... screens available for rodent protection.
Send for Bulletin 6-1P1

CUSHION BASE, OPEN TYPE, PROTECTED—1/20 to 5 H.P.
A.C., Single or Polyphase
Send for Bulletin 6-1P1

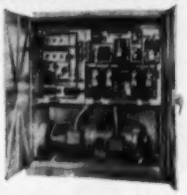
TOTALLY ENCLOSED FAN COOLED
1 to 100 H.P., A.C., Single or Polyphase
Send for Bulletin 6-1P1

FLANGE BRACKET (NEMA "D")
Round, short frame—for horizontal or vertical operation
Send for Bulletin 6-1P1



FACE TYPE BRACKET (NEMA "C")
With feet for motor-mounted equipment
Send for Bulletin 6-1P1

EXPLOSION PROOF MOTORS
2 to 100 H.P.
UL approval Class I, "C" and "D"
Class II, "E," "F" and "G"
Send for Bulletin 6-1P45



SELECTIVE SPEED DRIVES
1 to 150 H.P.
Offering a Wide Range of Closely Controlled Speeds
Send for Bulletin 11-1P1

Century Performance-Rating means that you can select precisely the right motor size, speed, frame, mounting and torque characteristics to fit the needs of each installation.

Performance-Rated© MOTORS
⅓ to 400 H. P.

Mail this coupon for FREE bulletins

GEAR MOTORS—1 to 125 H.P. (parallel)
⅓ to 3 H.P. (right angle or parallel)
A.C. or D.C., Speed to fit your need
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CENTURY ELECTRIC COMPANY

1806 Pine St., St. Louis 3, Mo. • *Offices and Stock Points in Principal Cities*

To CENTURY ELECTRIC COMPANY, 1806 Pine Street, St. Louis 3, Mo.
Please send me the following bulletins:

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Name..... Title.....

Company.....

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City..... Zone..... State..... CE-37A

FLEXIBLE TUBING
for the
CHEMICAL INDUSTRY

On air intakes, lubrication, fuel, water and chemical lines . . . as flexible connections on storage tanks . . . to serve as expansion joints Penflex Flexible Tubing has proved itself in chemical plants across the nation. Rugged . . . tough . . . flexible Penflex Tubing is made to stand the most severe usage.

From ⅛" to 24" I.D. . . . bronze, galvanized or stainless steel Penflex makes all types and sizes of flexible metal tubing. Penflex "Flexineering"—the science of applying flexible tubing to fit the particular needs of the chemical industry—assures the right tubing on each installation.

When you require metal tubing that is tight as a pipe, but flexible . . . safe at high temperatures . . . can readily handle volatiles . . . and free from metal fatigue specify Penflex. Write for your copy of "Flexineering For The Chemical Plant" today.

Pennsylvania Flexible Metallic Tubing Company, Inc.;
7234 Powers Lane, Phila. 42, Pa. *Branch Sales Offices:*
Boston • New York • Chicago • Houston • Cleveland
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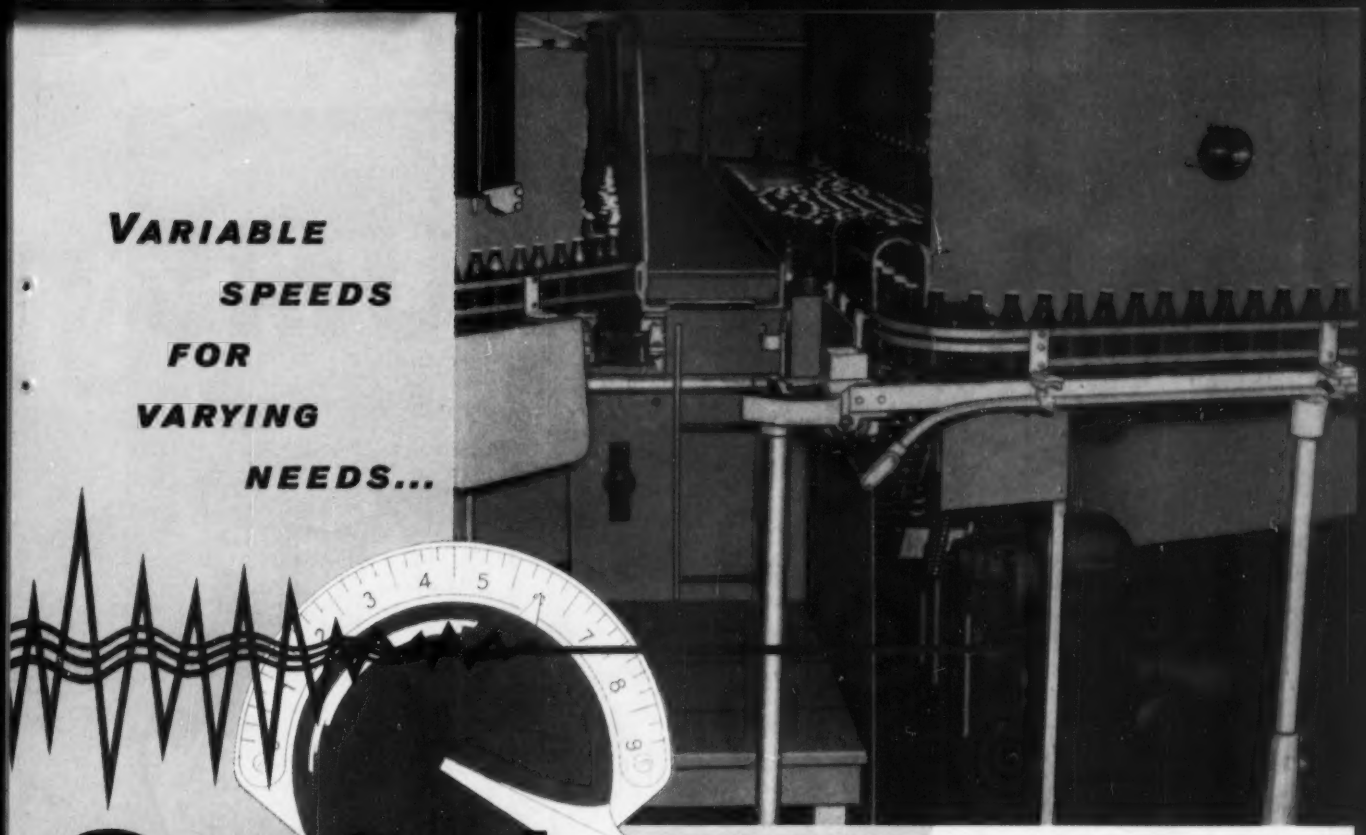
PENFLEX

HEART OF INDUSTRY'S LIFELINES



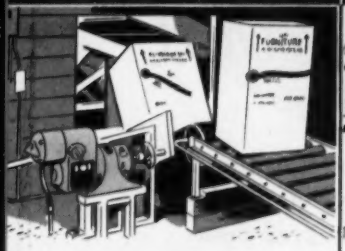
VARIABLE SPEEDS FOR VARYING NEEDS...

Control conveyor speeds with U.S. VARIDRIVES

NOW FAST, NOW SLOW THE BOTTLES GO

Two U. S. Varidrive motors provide the answer to the problem of varying the speed of the circular rotating table and conveyor for this pasteurizer. The use of Varidrives eliminates adjustment troubles and gives the operator accurate control of the conveyor and table, to suit filler or labeler capacity. Varidrives give added versatility to conveyors in all types of industry. Varidrives are available from ¼ to 60 h.p. Speeds 2 to 10,000 rpm.

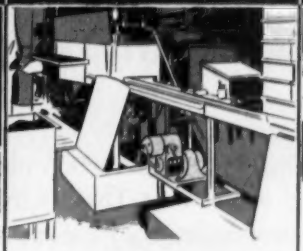
FURNITURE CONVEYOR



VARIDRIVE "SETS" THE TEMPO

As loading and packaging requirements vary, a fractional horsepower Varidrive provides just the right speed for this furniture conveyor.

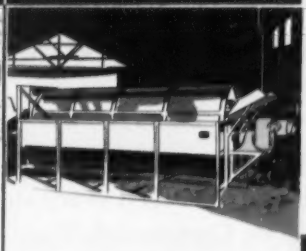
TILE GLAZING



A "CHANGE OF PACE" WITH CONTROL

Since tile glazing time varies, conveyor speeds must also vary. This VA Totally-Enclosed Varidrive powers the tile conveyor at the proper speed for best results.

FOOD INDUSTRY



JUST "SAY WHEN"

In this application a U. S. Varidrive provides maximum production by coordinating the washing operation with the volume of carrots entering the tumbler.

Versatile VARIDRIVE for additional applications:

PUMPING	SPOOLING
PUNCH PRESSES	MIXING & BLENDING
LATHES	CANNING
EXTRUDERS	GRINDING
PACKAGING	VENTILATION
	BUFFING

U.S. Electrical MOTORS

MAIL COUPON NOW

U.S. Electrical Motors Inc. CE-10
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☐ Send U. S. Varidrive Bulletin #1797

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COMPANY_____

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CITY_____ ZONE____ STATE_____

Continental FIBRE DRUMS

quality controlled from forest to finished product

Only a company that has its *own* woodlands, paper mills, and production plants can turn out a fibre drum that's quality controlled every step of the way. That's why you get the best drum on the market from Continental. These drums can't be beat for rugged durability . . . give extra protection to regular products or dangerous chemicals. Their light tare weight means savings at today's high freight costs, too. What's more, Continental's fibre drums are neat and trim, tailored to your product, feature quality printing or spray painting.

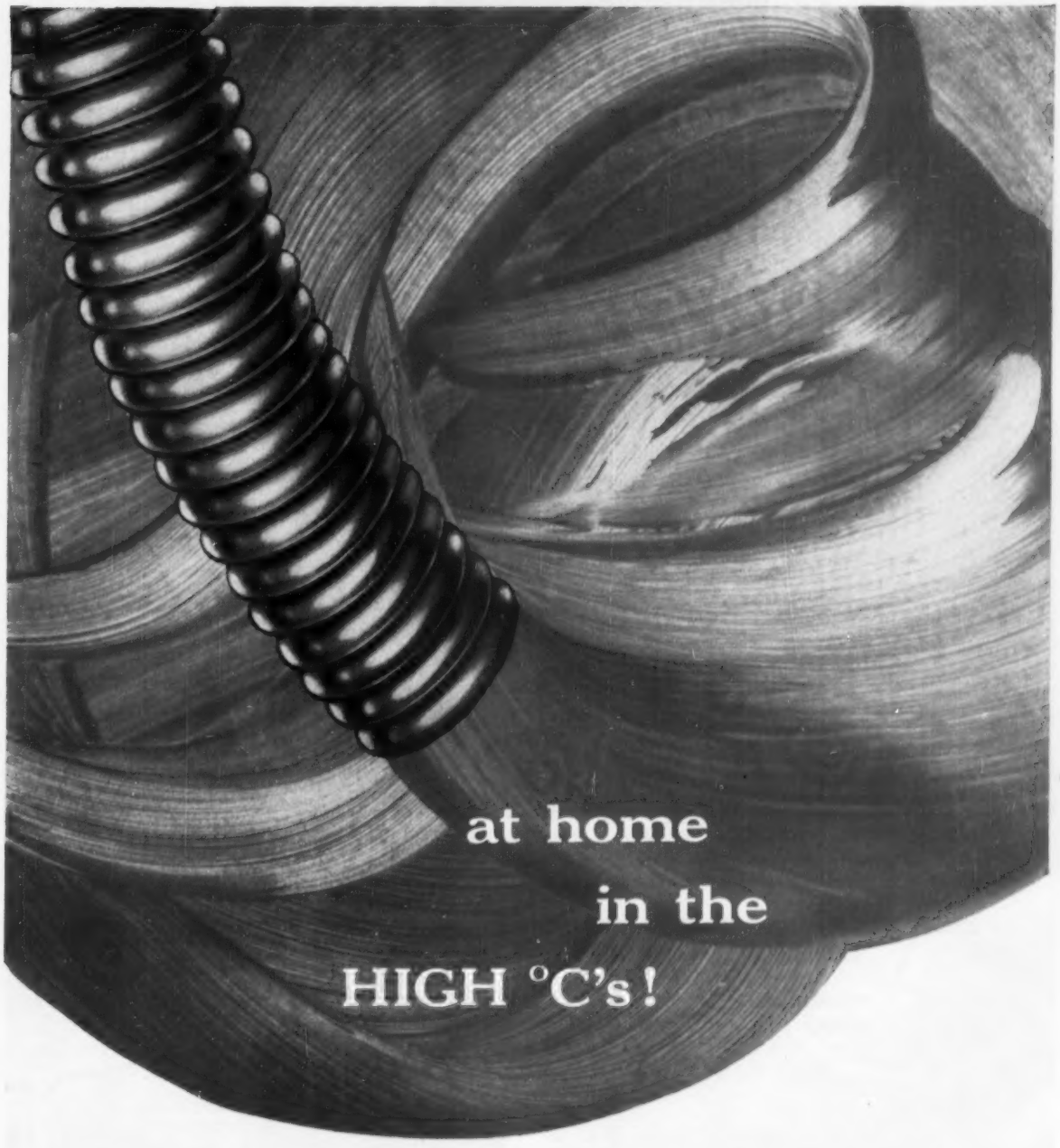
So check Continental's fibre containers — Leverpak, Stapak or Fiberpak. You'll get bigger profits, lower packaging and operating costs, too. Call Continental soon, won't you?

CONTINENTAL CAN COMPANY

TAILOR-MADE PACKAGE SERVICE

FIBRE DRUM DIVISION • VAN WERT, OHIO

New York • Philadelphia • Pittsburgh • Tonawanda • Cleveland • Chicago • Atlanta • St. Louis • San Francisco • Los Angeles • Eau Claire • Boston



PUT ATLANTIC FLEXIBLE STAINLESS STEEL HOSE TO WORK in any inferno of high temperature and high pressure corrosive gases and liquids. It Stands Up! . . . Every inch . . . JOB TESTED & CERTIFIED . . . for unequalled leakproof qualities, durability, strength and lightness. Use it to control movement and vibration . . . correct misalignments . . . to compensate for expansion and contraction . . . in process lines . . . for loading and unloading.

Available in sizes ¼"-4" I.D. inclusive with appropriate fittings. Produced in various alloys of stainless steel —— in monel, bronze, and carbon steel. Write for Bulletin 21-A. See our Catalog in Sweet's File for Product Designers.

ATLANTIC METAL HOSE CO., INC.

329 Dyckman Street, New York 34, N.Y.

HOW *HERCULES* HELPS...

BEAUTY AND PERMANENCE are combined in New York City's new Coliseum, headquarters for conventions and trade shows. Air-entrained concrete was used on this project. As an air-entraining agent, Hercules Vinsol® Resin improves the basic properties of concrete blocks, precast forms and prepared masonry cements, as well as those of poured concrete structures.

SAFETY COMES FIRST with the Cleveland, Ohio, Transit System. That's why the System's 50 new 48-passenger buses have a driver's area finished in multicolor lacquer based on Hercules® nitrocellulose. The easy-to-clean multicolor finish minimizes glare and prevents reflection from sun and headlights. (*Described in U. S. Patent No. 2,591,904, held by Coloramic Coatings, Inc., Los Angeles.*)

EXPANDING CONSUMPTION—The use of natural and synthetic rubber has more than doubled in ten years. To anticipate future demands, Hercules has constructed this pilot plant at Hattiesburg, Mississippi, where new rubber chemicals are being readied for commercial production.

HERCULES POWDER COMPANY
INCORPORATED
952 Market Street, Wilmington 99, Del. Sales Offices in Principal Cities

SYNTHETIC RESINS, CELLULOSE PRODUCTS, CHEMICAL COTTON, TERPENE CHEMICALS, ROSIN AND ROSIN DERIVATIVES, CHLORINATED PRODUCTS, OXYCHEMICALS, INDUSTRIAL EXPLOSIVES, AND OTHER CHEMICAL MATERIALS

G58-6

HERCULES

CHEMICAL MATERIALS FOR INDUSTRY

When you plan to purchase new motors, you'll want the best—at the most reasonable cost. You will demand built-for-the-job efficiency, and no compromises with quality. You will expect co-operation at each stage of design and development—and on through to manufacture and delivery on the date specified. And after installation, you'll want long-life and the minimum of down-time for servicing. At all times, you will appreciate being a special customer of the motor manufacturer—whether you buy one, or one hundred motors.

All this you can expect from Diehl. The best built-for-the-job motor at the most reasonable cost. You will get the benefit of 69 years of Diehl know-how applied to your particular requirements. For Diehl design, sales and installation engineers comprise one of the finest teams of electric motor experts in America today.

The emphasis at Diehl is on close liaison with all customers at every stage of production. Give your power problems to a Diehl motor specialist. Get the right answers and the best motors—fast. You invest in performance when you design with Diehl.

Diehl

DIEHL MANUFACTURING COMPANY
Electrical Division of THE SINGER MANUFACTURING COMPANY
Finderne Plant, Somerville, N. J.

Please send me Bulletin No. 3526

Name_____

Company_____

Street_____

City_____ State_____

INTEGRAL AND FRACTIONAL HORSEPOWER MOTORS ARE AVAILABLE IN A WIDE RANGE OF TYPES AND SIZES

BRIEFS
for caustic soda buyers

Choosing a supplier
New booklet
New producing point

Some tips on supply logistics

Like all Hooker plants, this one in Montague, Michigan, is near deep water for a purpose—a purpose you might consider when choosing a supplier.

The water gives our customers the option of barge as well as rail delivery.

For many, the barge service means cheaper delivery. For others, it offers an alternative means of shipment in case of interruption in rail service.

Here are three other "pluses" to consider when you select a chlorine-caustic supplier. (As a Hooker customer, you enjoy all of them):

1. Competent engineering help. An experienced supplier can give you assistance in designing or revamping your chlorine or caustic soda handling system.

2. Operating assistance. Your supplier's technical servicemen can often spot—and help you correct—operating troubles before they become serious. Do you get the advantage of periodic technical service visits?

3. Safety programs. Your supplier should be able to give you up-to-date advice on safe equipment and handling methods.

We'll be glad to enlarge on these points, with your requirements in mind. Simply phone or write the nearest Hooker sales office.

New booklet, pocket size, offers useful facts on buying caustic soda.

Besides information on forms, grades, and shipping containers, contents include a factual discussion on 50% *vs.* 73% liquid caustic, and a handy nomograph to help you figure which strength is your better buy.

There's also a nomograph to help you estimate your requirements for various process solutions.

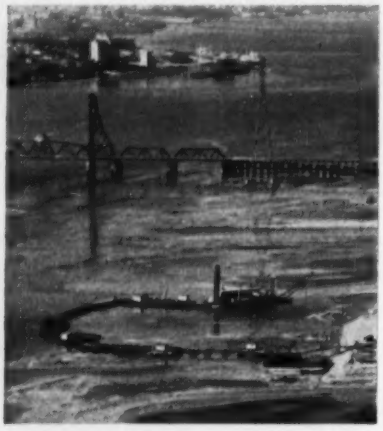
Check the coupon for a copy.

Progress report... The most ardent sidewalk superintendent would take delight in the building of our new chlorine-caustic soda plant at North Vancouver, B. C.

Huge dredges are moving 1,000,000 yards of sea bottom to build a 100-acre base for the plant, well above high tide.

When it's completed early in 1957, the plant will be Western Canada's first domestic source of caustic soda and chlorine. Owned and operated by Hooker Chemicals, Ltd., it will provide shorter supply lines by rail and barge, and small but real freight savings. It will eliminate the need to pay duty on caustic soda and chlorine.

If your company has a plant or plans to build one, in British Columbia, this is a good time to find out how Hooker Chemicals, Ltd., can serve you.



Check items you'd like to receive:

- ☐ *Caustic Soda Buyer's Guide* booklet
- ☐ Technical data on caustic soda

For information on these other Hooker chemicals, check below:

- ☐ Muriatic Acid
- ☐ Sodium Sulfide
- ☐ Sodium Sulfhydrate

Clip and mail to us with your name, title, company address.

HOOKER CHEMICALS PLASTICS

0-1012

HOOKER ELECTROCHEMICAL COMPANY

410 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.

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FROM Heat of Cat Cracking and Reforming

TO Extreme Cold of Liquid Oxygen

USE WEDGEPLUG NON-LUBRICATED STEEL PLUG VALVES

Valves that Lift, Turn, and Re-Seat in one operation. No plug lubricant is needed.

GENERAL SERVICE? Of Course!

Wedgeplug Valves meet the exacting requirements of the Petroleum, Petro-Chemical and Chemical Industries. The possibility of contamination is eliminated.

SEE YOU AT
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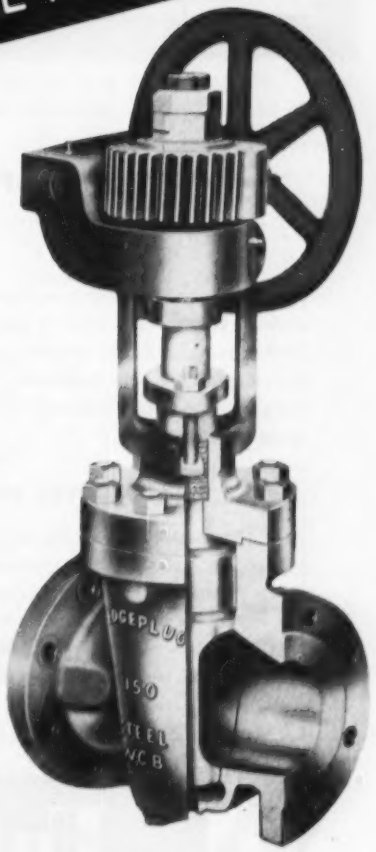
Wedgeplug Non-Lubricated Steel Plug Valves are available:

WRENCH OPERATED
HANDWHEEL OPERATED
WORM GEAR OPERATED

With Electric, Air Motor, Air Cylinder and other Operators.



WEDGEPLUG VALVE COMPANY, INC.
An Affiliate of
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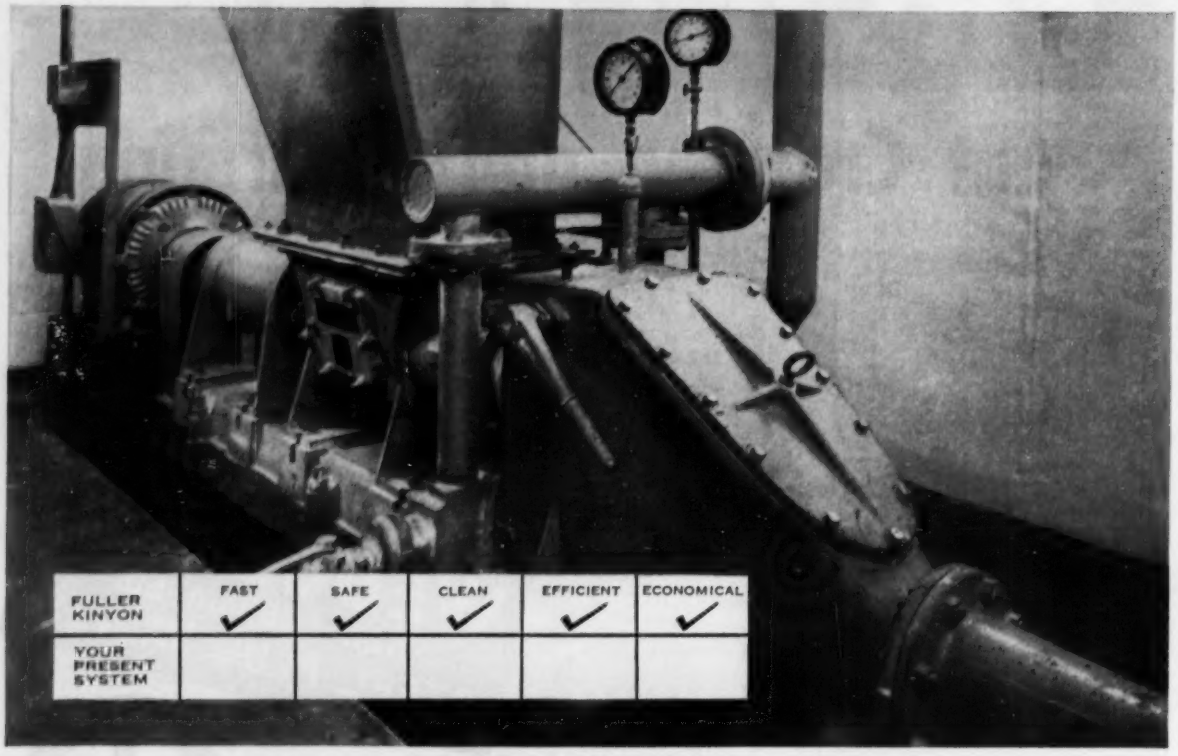
GENERAL OFFICES AND PLANT • BIRMINGHAM 2, ALA.

Write for Catalog No. 55-1-W

How many can't you check . . .



Fuller-Kinyon pump conveying flash-dried starch to dextrine or starch bagging department at rate of 12,500 lb. an hour. Conveying distance 600 feet.

. . . against your present dry pulverized materials handling method?

If there's just one of these practical features that you *can't* claim, you can be sure that its lack is adding a substantial amount to your annual conveying costs. To move bulk Portland cement, pulverized coal, limestone dust, flue dust, fly ash, starch, pulverized phosphate rock or any other dry materials of similar consistency, a Fuller-Kinyon System designed specifically for your plant will provide the best combination of efficiency and economy available and also afford the "extras" of safety, speed and cleanliness.

A FULLER-KINYON SYSTEM:

- *harnesses air to do the work
- *eliminates fire and explosion hazards
- *operates anywhere a pipeline can be run
- *entails no complicated or costly installation factors
- *reduces maintenance sharply
- *can be operated by one man
- *eliminates spillage—waste

Proof that these advantages have been long recognized is the fact that one or more Fuller-Kinyon Systems are serving in 98 per cent of the nation's cement mills as standard primary conveyors. Take a leaf from this service record. Get the facts as they apply to your plant and put Fuller's 30 years of pneumatic conveying experience to work for you.

P-163
3019

Fuller
. . . pioneers in harnessing AIR

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134 Bridge St., Catasauqua, Pa.
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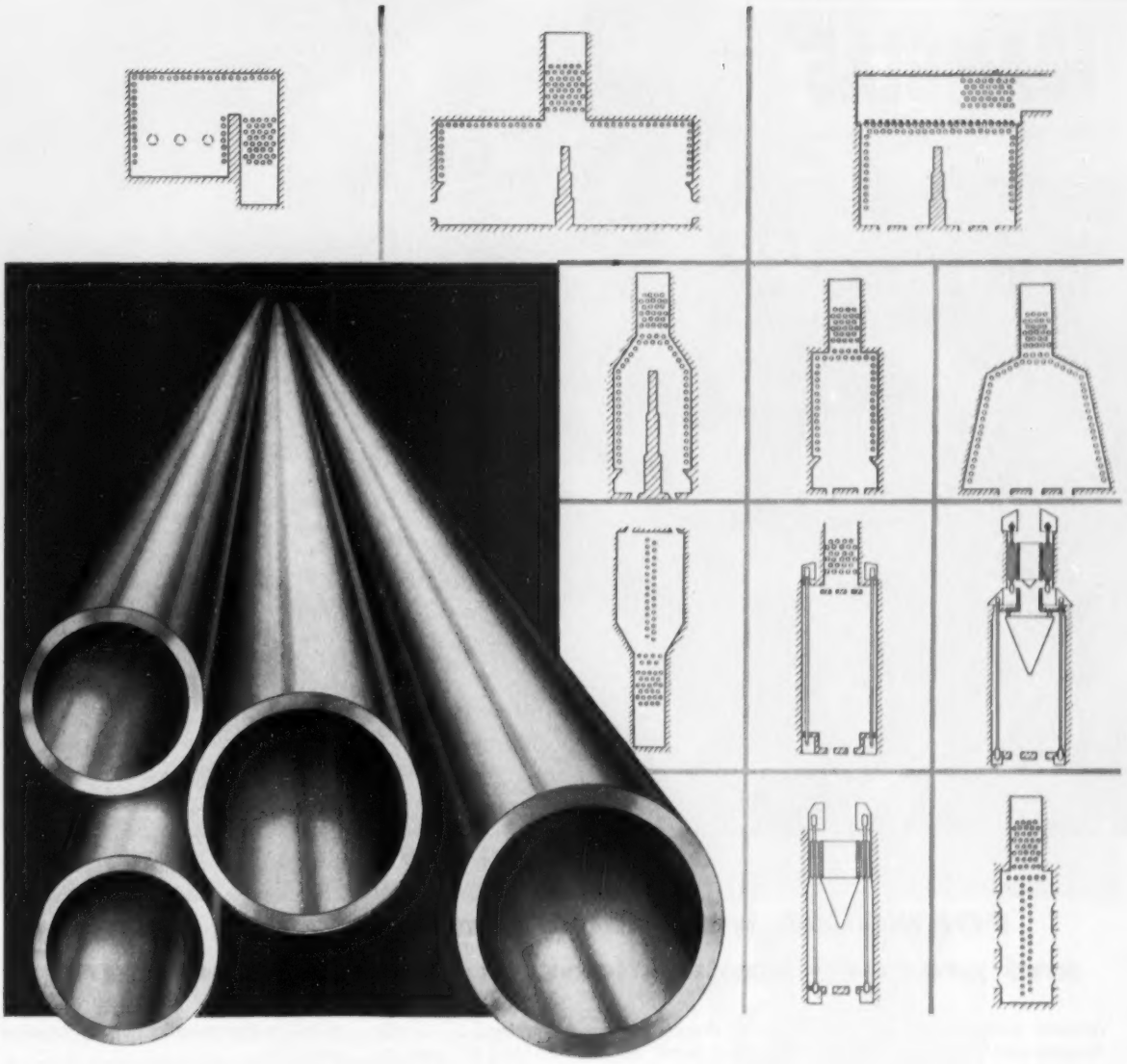


DESIGN ADDITIONAL SERVICE LIFE
INTO YOUR PROCESS HEATERS

...with B&W TUBING

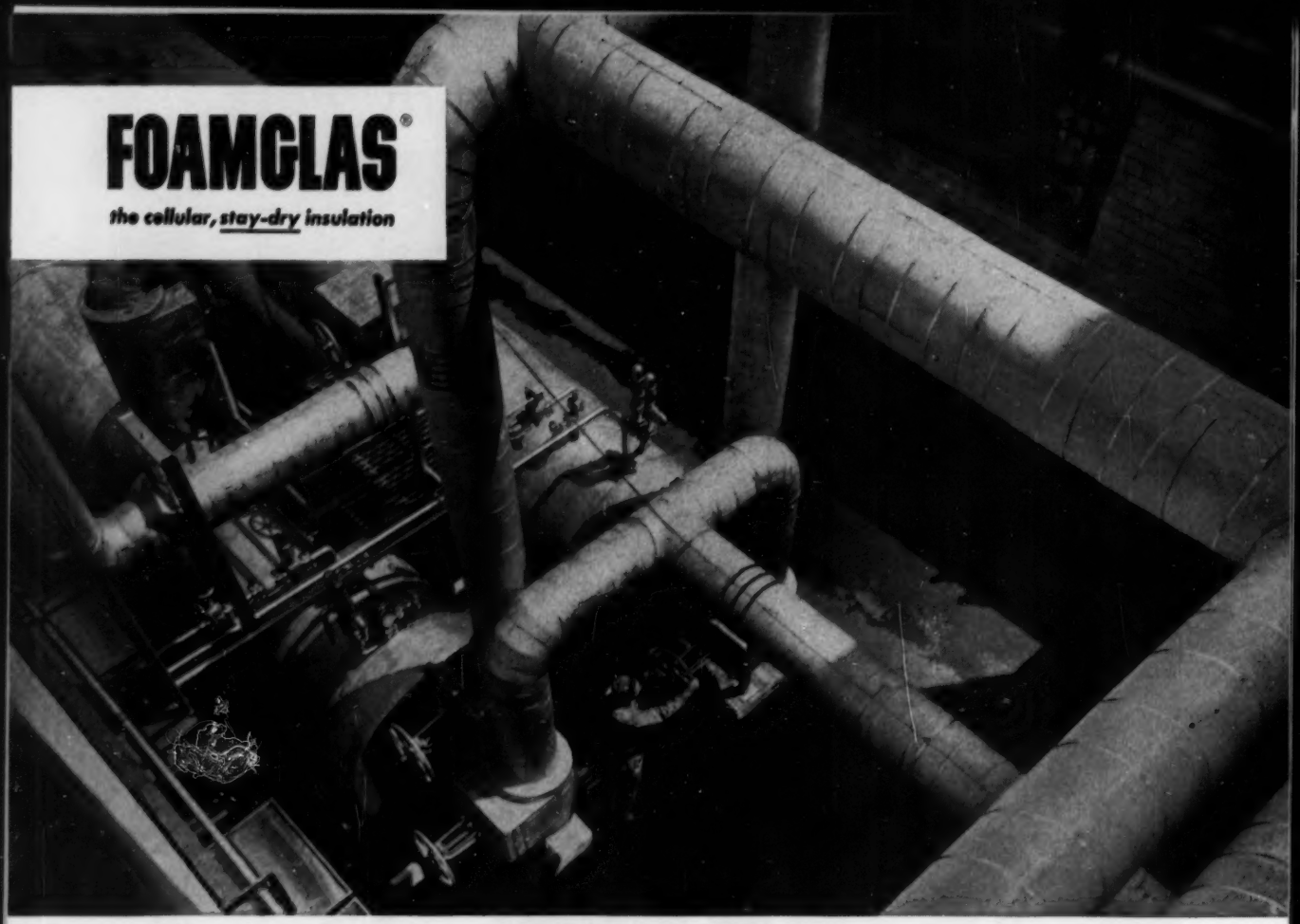
Long service life of process heater tubing for the oil refining and petrochemical industries dictates selection of a B&W Croloy to insure maximum corrosion and oxidation resistance, and fully satisfactory handling of unusual temperature and pressure conditions which may arise. Mr. Tubes —your friendly link to B&W—has facts and figures to help you choose the best tube for the job. Get in touch with him to discuss your heater tube requirements, for both original equipment and maintenance. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA-6062(P)

Seamless and welded tubular products, seamless welding fittings and flanges—in carbon, alloy and stainless steels

FOAMGLAS®

the cellular, stay-dry insulation

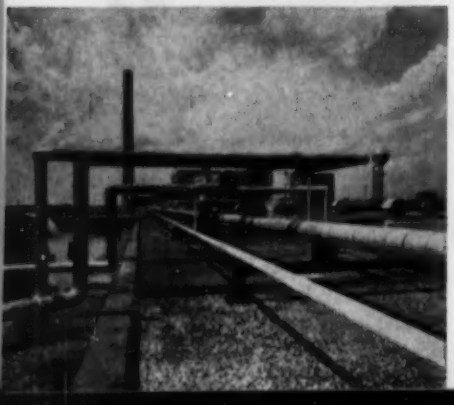


FOAMGLAS stays dry for constant insulating protection of Armour process piping and equipment.

FOAMGLAS insulation handles 7 vital plant and process applications at Armour Laboratories

Armour Laboratories, a division of Armour and Company, processes drugs and other pharmaceuticals in a multi-million dollar plant near Kankakee, Illinois. Their precisely regulated processing demands accurate control of plant and process temperatures in an atmosphere kept free of contamination. That's why inorganic FOAMGLAS plays a vital role in their operations. Here's where Armour uses the never-varying effectiveness of this unique all-glass thermal insulating material:

FOAMGLAS on Armour's plant roof and service piping eliminates insulation replacement headaches.



Process and service piping . . . 18,800 lineal feet of FOAMGLAS pipe insulation guards temperatures of ammonia, ethylene glycol, chilled water and other fluids.

Process and storage tanks and vessels . . . 4400 board feet of FOAMGLAS helps hold contents at constant temperature.

Cold room walls, floors and ceilings . . . 8 inches of FOAMGLAS totalling 244,000 board feet safeguards pharmaceuticals and insures economical operation of refrigerating equipment.

Entire plant roof area . . . over 175,000 square feet of 2" FOAMGLAS roof insulation contributes to efficient control of interior plant temperatures.

FOAMGLAS has passed every test of performance in all its uses during the three years Armour's plant has been in operation. Its inorganic composition has prevented the insulation from becoming a source of contamination from bacterial growths. Because FOAMGLAS is vermin-proof, non-absorbent and incombustible, costly insulation replacement has been eliminated. Most important, since FOAMGLAS is moisture-proof, its thermal efficiency has remained constant.

Whatever *your* plant and process insulation problems, you'll solve them best with FOAMGLAS . . . the inorganic cellular glass insulation that *stays dry for constant insulating protection* under the most demanding service conditions. Prove it to yourself with six simple tests easily performed in your own office. Send for a sample and complete testing directions today. Write . . .

Pittsburgh Corning Corporation

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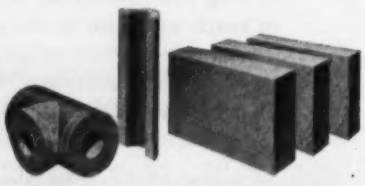
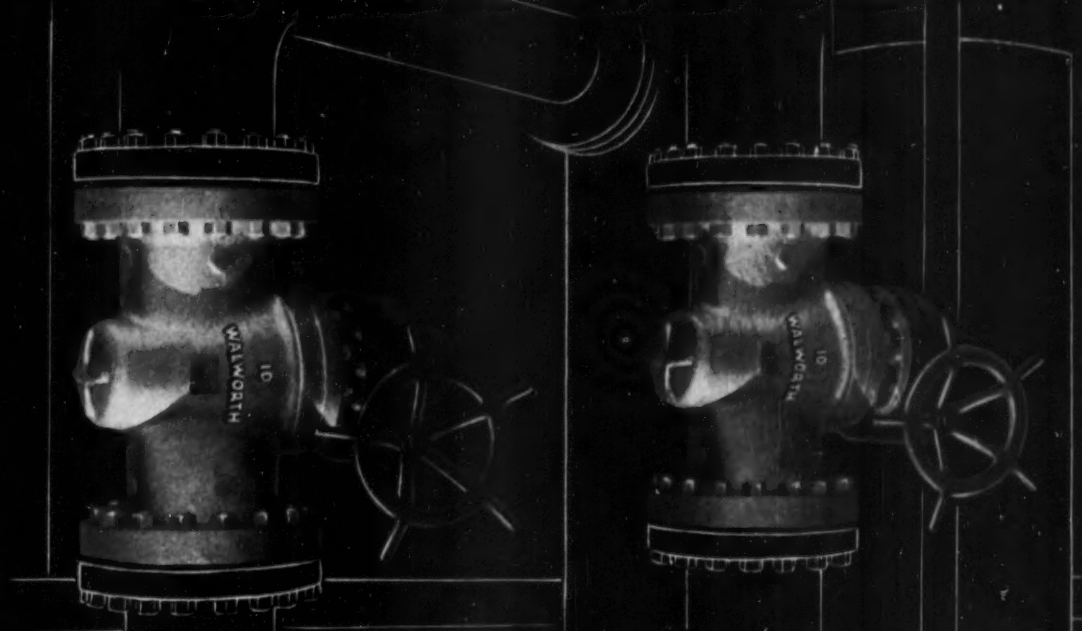
Pittsburgh 22, Pennsylvania
In Canada: 57 Bloor St. W., Toronto, Ontario



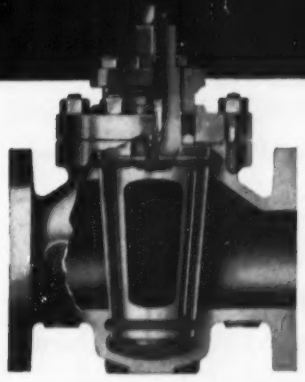
Also manufacturers of PC Glass Blocks

WALWORTH



LUBRICATED PLUG VALVES

Better because . . . **They are *pressure sealed* with an insoluble lubricant readily renewed while the valve is in service. Lubricant completely surrounds the plug ports assuring a tight seal against leaks. It also insures ease of operation by reducing friction between the body and the plug while at the same time protecting the finished surfaces against corrosion and wear.**



Lubricant system of a Walworth No. 1700F Regular Gland, Wrench Operated, Steel-iron, *Lubricated Plug* Valve. Other Walworth *Lubricated Plug* Valves include Single Gland, and Ball Bearing types. Sizes to 30-inches — pressures to 5,000 psi, and for vacuum service.

Walworth Lubricated Plug Valves are the most satisfactory valves available for the handling of gritty suspensions, and many other destructive, erosive, and corrosive industrial and chemical solutions.

They are ideal for general refinery and pipeline service.

FOR COMPLETE INFORMATION, *SEE YOUR WALWORTH DISTRIBUTOR OR WRITE FOR ILLUSTRATED CIRCULAR*

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HOW Proctor DRYING EQUIPMENT

has paced GROWTH in the Chemical Industries

We are proud to have served during this period of greatest growth in the chemical industries. The Proctor record shown here is without equal in the field—represents a revolution in the economics and production possibilities of continuous wet processing.

•

No other dryer manufacturer can offer the understanding, engineering experience, and test facilities which PROCTOR has developed over the years.

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PROCTOR dryers, with Proctor pre-forming and feeding equipment have opened new concepts of expansion for the industry through the years—now recognized the world over for their quality and dependability in rugged service conditions.

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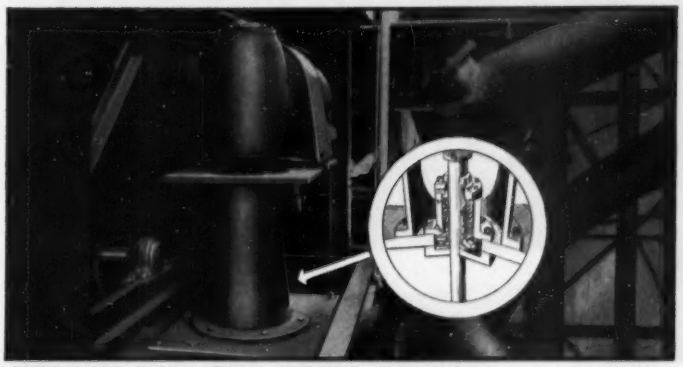
1900	Tray Truck Dryers
1923	Job-engineered Continuous Conveyor Dryers
1923	Chemical Loop Dryers
1934	Fin Drum Feed
1937	Granulator
1938	Roller Extruder
1938	Scoring on Filter
1953	Spray Dryer

Proctor **PROCTOR & SCHWARTZ, INC.** Philadelphia 20, Pa.
Manufacturers of Industrial Drying Equipment and Textile Machinery

International

FIRST in Chemical Mixing and Processing

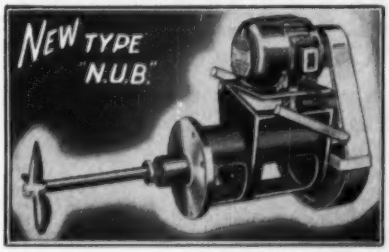


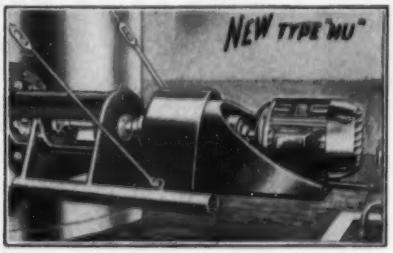
TYPE "LFR" SLOW SPEED TURBINE TYPE MIXER — 1 to 100 H.P.

Low Head Room—Speed Ranges 1 to 350 R.P.M.—Mechanical Efficiency 96 to 98½%—AGMA ratings—All steel gear housing—Equipped with Mechanical Seal or Standard Packed Stuffing Box—for open or closed tank operation.

Meeting today's demand for New and Important Advancements in the Chemical and Allied Industries,—INTERNATIONAL ENGINEERING offers the most complete line of *improved* Processing Equipment ever presented. Whether you're expanding your present facilities, or building a new plant be sure to check with INTERNATIONAL for the latest engineering developments in the correct and most economical MIXING, BLENDING, TREATING AND GRINDING of Chemical Components.

Remember—INTERNATIONAL manufactures and guarantees the Equipment you need, in any required sizes and capacities . . . Ask for Special Bulletins on any product—no obligation, of course.

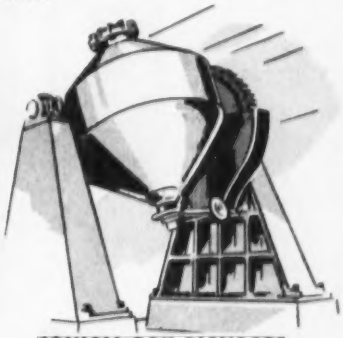




SIDE ENTERING MIXERS—½ to 30 H.P.

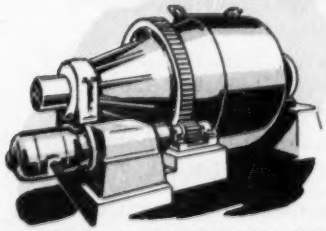
INTERNATIONAL can furnish either standard packed Stuffing Box or Mechanical Seals—On most standard types of Side Entering Mixers either Seal can readily be converted to the other, as desired.

SHUT-OFF CONNECTION on Side Entering Mixers allows repacking or replacement with either Standard Stuffing Box or Mechanical Seals with a full head of liquid, without appreciable leakage.



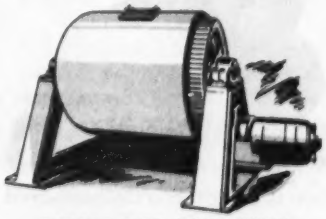
CONICAL DRY BLENDERS

Specially Engineered and adapted to your Product. INTERNATIONAL Conical Dry Blenders are the standard of Lower Blending Costs for Hundreds of Chemical Products. Standard sizes ranging in capacity from 25 to 10,000 lbs. for densities of from 20 to 100 lbs. per cu. ft.



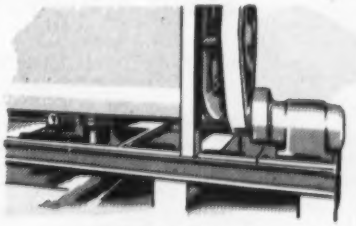
CONTINUOUS CONICAL BALL MILL

For Wet and Dry Grinding. Adapted to open or closed circuit operations. Welded Steel Construction, with high production and mechanical efficiency. Furnished in all standard sizes and capacities from 36" x 8" to 120" x 48" inclusive.



PEBBLE AND BALL MILLS

Of Welded Steel Construction, and furnished in all Standard Sizes from 18" x 24" to 96" x 144" inclusive, with 9 different drive arrangements. Equipped with Anti-Friction, Self-aligning Roller Bearings, reducing h.p. requirements by as much as 25%.



RIBBON MIXERS

INTERNATIONAL Ribbon Mixers are so designed that any desired proportion of various materials can be thoroughly mixed. Simplified Agitator Construction allows quick removal and easy cleaning. 16 Standard Sizes from ¼ to 175 cu. ft. capacity.

Technical Bulletins Available

Top Entering Agitators	73, 76, 76-A, 81
Side Entering Agitators	73-B
Portable Mixers	74-A
Mixing & Extruding Machinery	62-A
Dry Blenders & Ribbon Mixers	78
Grinding & Muffling Pans	5
Ball & Pebble Mills	100-A, 100-B
Laboratory & Pilot Plant Equipment	77-A
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For the best in mixing and processing—consult

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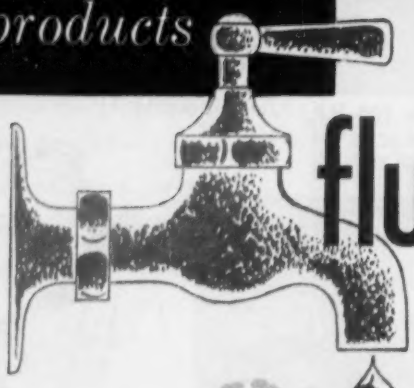
SULPHUR

helps to create headline products



fluoridated WATER

Some communities will, some won't . . . adopt fluoridation of drinking water for the purpose of reducing tooth decay. The subject is hotly debated but one thing is certain: wherever fluoridation is adopted a derivative of Sulphur will enter the picture.

Several chemicals can be used for fluoridation but they all stem from hydrogen fluoride. To produce this gas, a fluoride-bearing mineral is reacted with sulphuric acid.

As today's Headline Products' are studied, it's significant that so many require for their production one or more derivatives of Sulphur.

Texas Gulf Sulphur Co.

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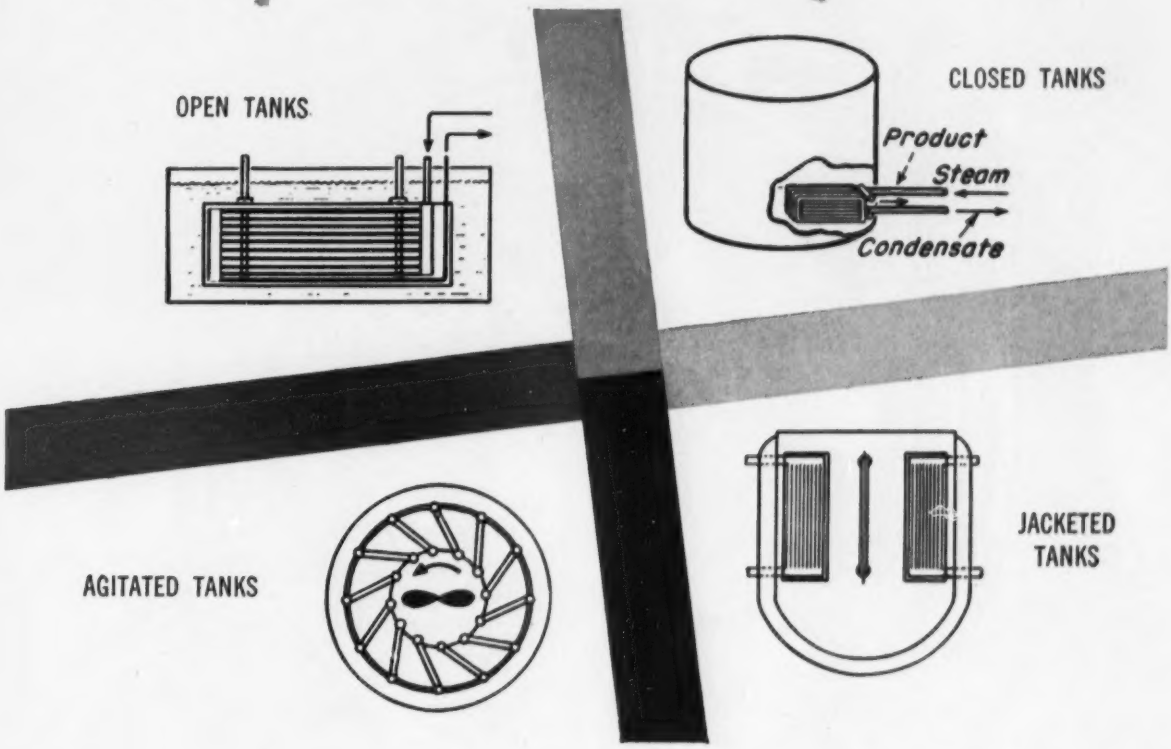
Sulphur Producing Units
- Newgulf, Texas
- Moss Bluff, Texas
- Spindletop, Texas
- Worland, Wyoming

in any corner of the plant...



in any type of tank

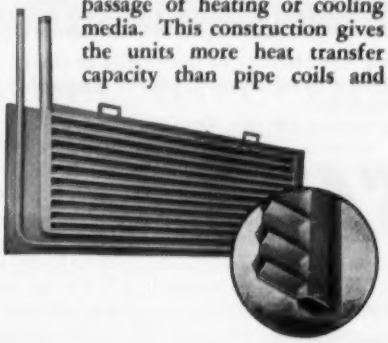
PLATECOIL® *cuts heating and cooling costs*

You achieve "custom" performance from standard units when you replace old-fashioned pipe coils with Tranter Platecoil.

Available in many sizes, Platecoil consists of two embossed sheets of metal, welded together to form channels for passage of heating or cooling media. This construction gives the units more heat transfer capacity than pipe coils and permits space and weight savings of up to 50% compared with pipe coils. So Platecoil can be used anywhere you use pipe coil — and in many places where pipe coil is too bulky and too complicated.

Standard Platecoil units solve most problems, but special units (curved, embossed on one side only, special finishes) can be obtained on special order. Cold rolled and stainless steel units are available from stock, and on special order, units can be made from Carpenter 20, Monel, Hastelloy B, Hastelloy C and Nickel.

Investigate Platecoil for your use today. Send for Bulletin P-61 for complete information on Platecoil installations and its money-saving advantages.



PLATECOIL® division
TRANTER MFG., Inc. LANSING 4, MICH.

You'll find our catalog in Sweet's Plant Engineering File

TAKE A TIP FROM

ON HANDLING TOUGH CORROSIVES!

USE **CHIKSAN**

LOADING ARMS

To maintain smooth production schedules, Eastman Kodak brings corrosive solvents and acids to its Rochester plant via truck from nearby tank farm storage. Corrosive action, however, was destroying loading hoses after comparatively short periods of use. To overcome this costly problem, Kodak replaced its hoses with Chiksan Loading Arms. That was 10 years ago. Today, there are over 40 Chiksan Loading Arms in service at Kodak Park and not one record of product fatigue to date.

Whatever your fluid handling requirements, be it corrosive or other, insist on Chiksan Loading Arms—the time proven answer where the accent is on service, safety and speed.

There's a Chiksan Catalog waiting for you. Send for it today.

FOR CATALOG, WRITE DEPARTMENT 12-10

fmc **CHIKSAN**

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

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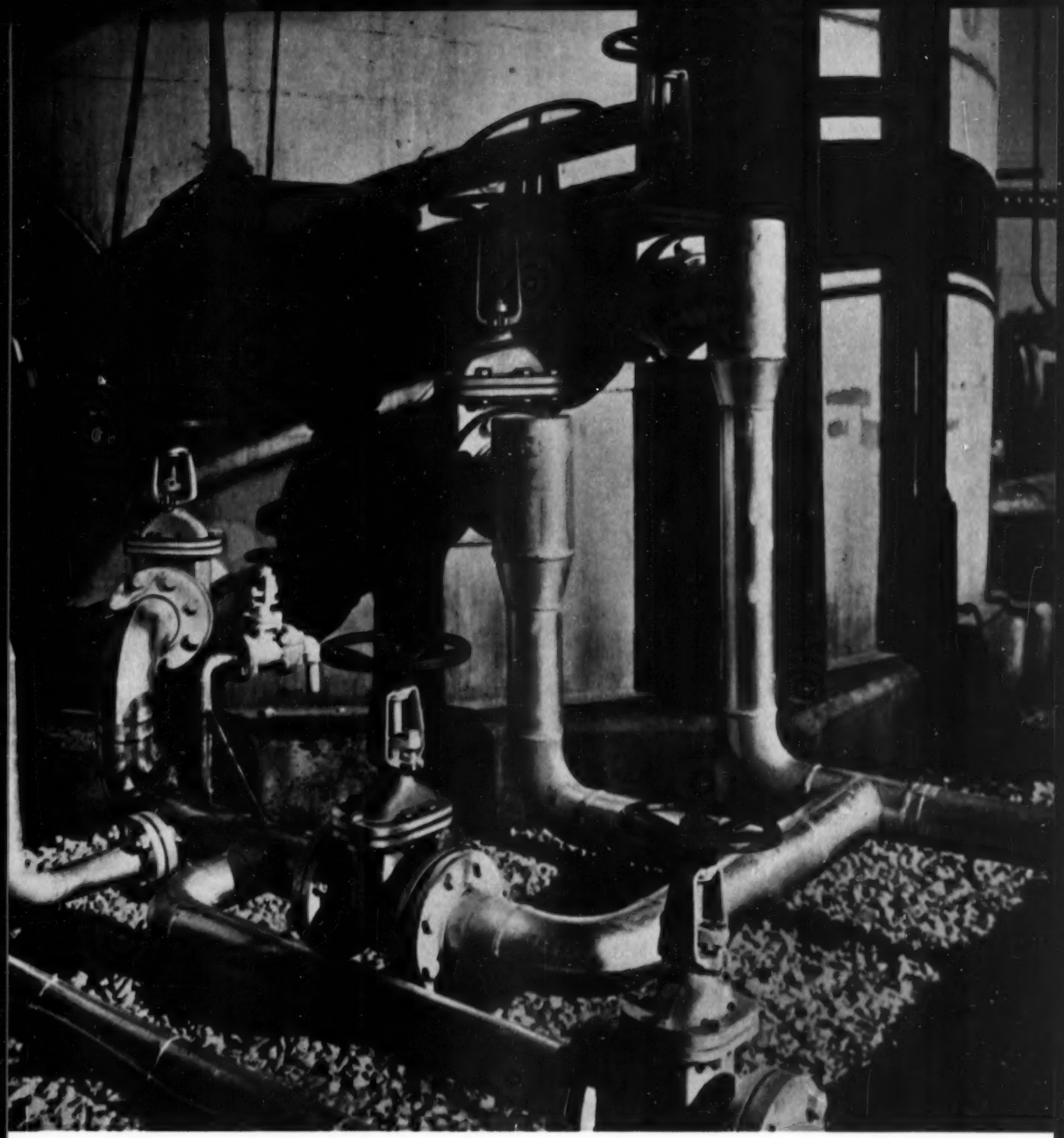


Meet three synthetic detergent experts

You're looking at a Philadelphia installation of The Atlantic Refining Company (expert #1).

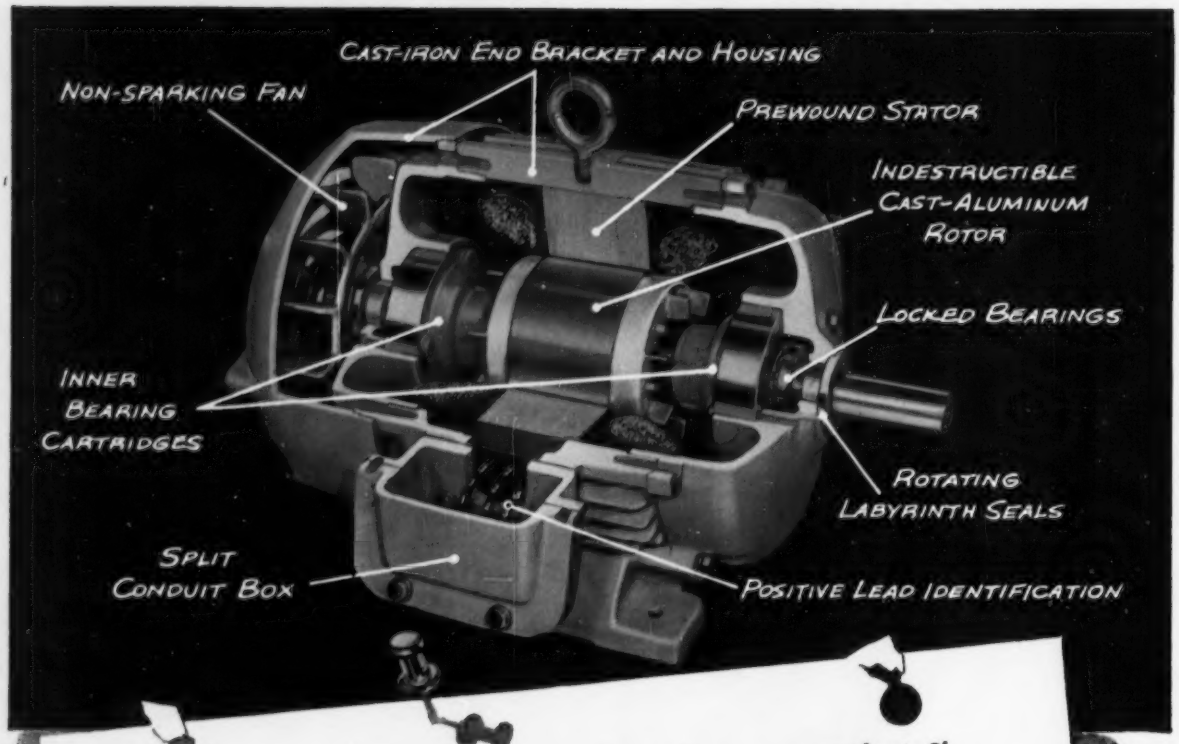
Ultrawet, an important ingredient of synthetic detergents, is the product being processed in this modern plant designed and built by The H. K. Ferguson Co. (expert #2).

Helping to prevent contamination of the product due to corrosion are long-lasting, red-wheeled valves made by Aloyco (expert #3). Made of corrosion-resistant Aloyco 20, the gate and globe valves used here handle a 98% concentration of sulfuric acid at up to 180° F.

Whatever your process, whichever corrosives you need to keep in line, it pays to check first with Aloyco. As the world's largest manufacturer of corrosion-resistant valves exclusively, we're most likely to have the valve you need. Write Alloy Steel Products Company, Inc., 1301 West Elizabeth Ave., Linden, New Jersey. 6.3

Longer Lasting
ALOYCO
VALVES
FOR IN CORROSIVE SERVICE

Subsidiary of Walworth Company



Are you getting all these extras in the motors you buy?

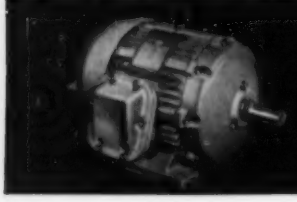
Louis Allis gives them to you in the new L. A. enclosed and explosion-proof motors

For years, Louis Allis has specialized in special motors for many of industry's toughest drive problems. Such installations call for extreme care in both motor design and manufacture—care that has become a habit with us. We build our enclosed and explosion-proof motors with the same special care.

What does this mean to you? It means that you get a motor with extra features—a motor that runs better, lasts longer. Here are a few of the extra reasons why:

- These new motors carry Underwriters' label for use in four groups of hazardous locations—Class I, Group D, and Class II, Groups E, F, and G. This four-group approval for a single motor simplifies your stocking problem.
- New, exclusive phenolic impregnating varnish provides high thermal and chemical resistance. It remains resilient and resists aging, prolonging the life of the motor.
- Inner bearing cartridges lock bearings to end bracket and form explosion-quenching seal along the shaft. Inner race of bearing locked to shaft, reducing end play—an extra quality feature.
- Rotating labyrinth seals keep dirt and moisture out of the bearings—keep grease in.

There are many other features such as a new diagonally split conduit box, sturdy cast-iron construction, positive lead identification, non-sparking fan. Our new bulletin No. 1700 shows why you get extra value for your dollar in a Louis Allis explosion-proof motor. Write for your copy.



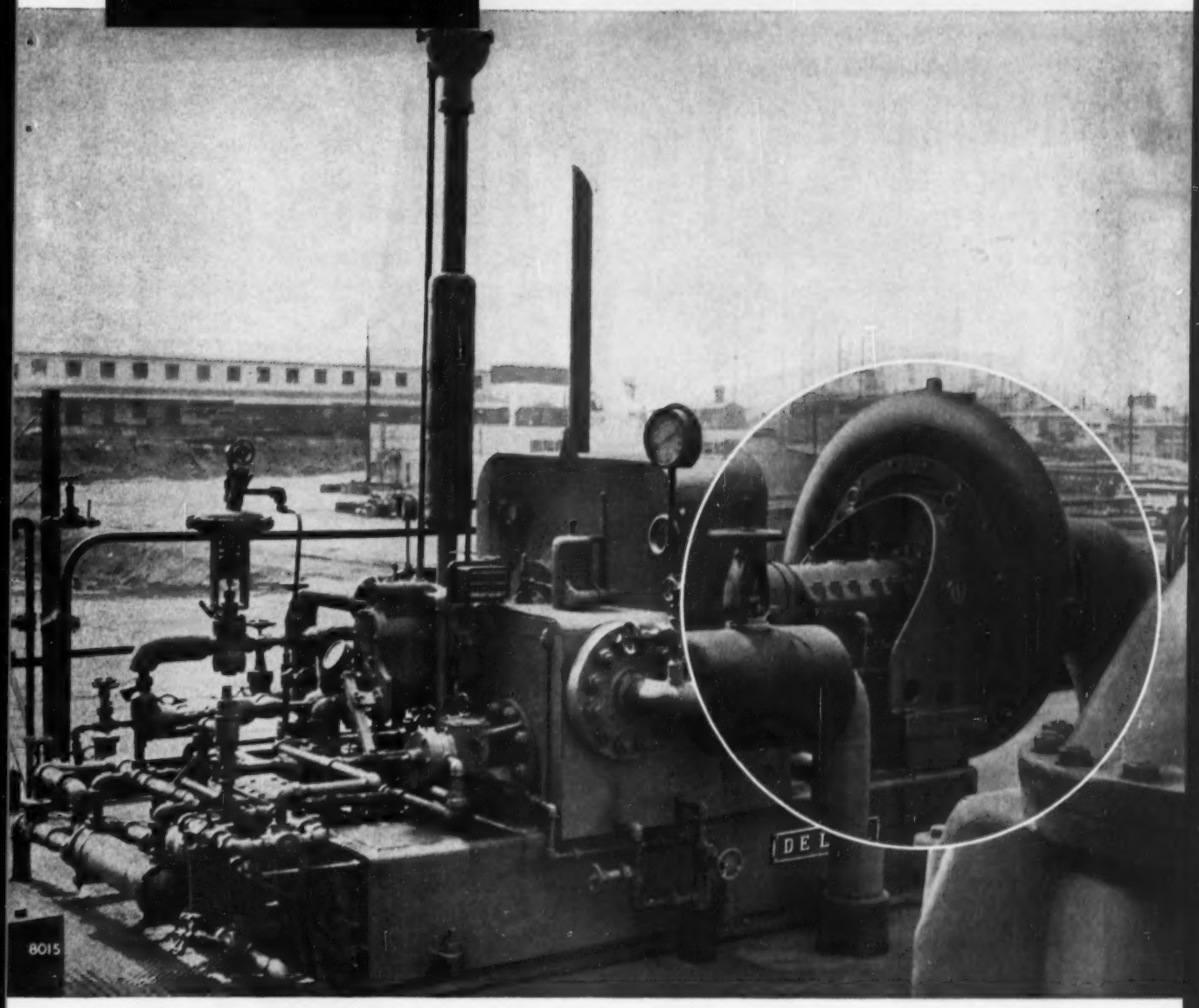
New LA line explosion-proof motors are available in rerated frame sizes 182 through 326U, and in ratings of 1 to 30 hp, 3 phase, and 1 to 5 hp, single phase. Also available with Underwriters' approval for Class I, Group C hazardous locations.

EP-102

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

DE LAVAL
CENTRIFUGAL
BLOWER

controls air in cat cracker at Standard Oil of California



This De Laval centrifugal blower, selected by the Fluor Corporation, is on stream at the Standard Oil Company of California's new cat cracker in El Segundo. For control air service, this blower delivers 9,500 cfm; inlet pressure is 15.4 psig and discharge pressure 19.4 psig. The blower is driven by a De Laval 220 brake horsepower MCP Turbine operating at 800 psig with a temperature of 650 F; it has all labyrinth shaft packing for high back pressure service.

In addition to single stage designs, De Laval makes a complete line of equipment for all refinery services, including multi-stage compressors driven by De Laval multi-stage turbines for condensing, non-condensing and automatic extraction applications.

Send for new Bulletin 0504

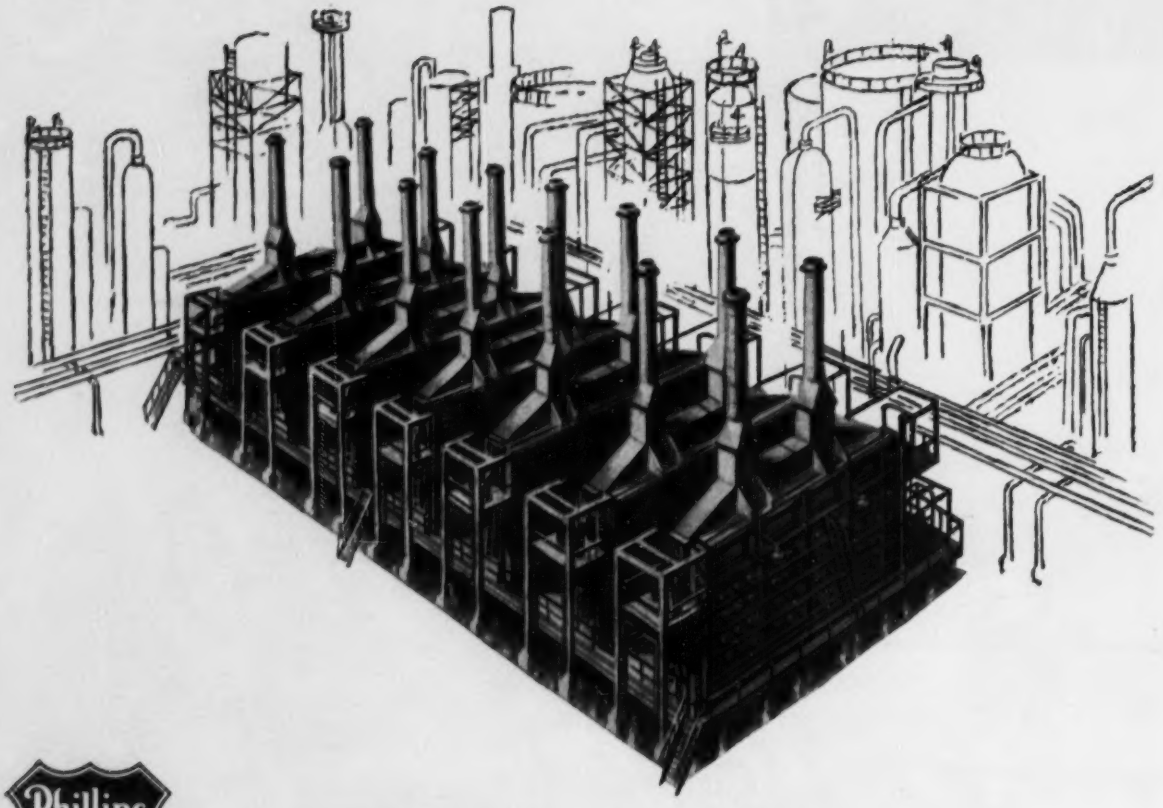
DE LAVAL *Centrifugal Blowers*

DE LAVAL STEAM TURBINE COMPANY

803 Nottingham Way, Trenton 2, New Jersey

DL 388

IN ETHYLENE PRODUCTION...



Phillips 66 too, will soon benefit ...from SELAS Gradiation® Heating

A battery of seven Gradiation Heaters is now under construction at the new Phillips ethylene plant, Sweeney, Texas. The plant was designed and is being built by Stone and Webster Engineering Corporation.

- Operation at the designed capacity from the moment of startup.
- "On stream" periods, without shutdown, well in excess of 30 days.
- High conversions and selectivity.
- Versatility in processing widely different feed stocks.
- Zone Control of heat input, which enables meeting any time-temperature curve in pyrolytic or catalytic reactions and high temperature preheating.
- Uniform heat distribution on the entire tube surface extends tube life by eliminating local overheating and material degradation at the tube wall.
- Controlled combustion, with little or no excess air to cause external oxidation of the tubes . . . no lag in response to controller demand.

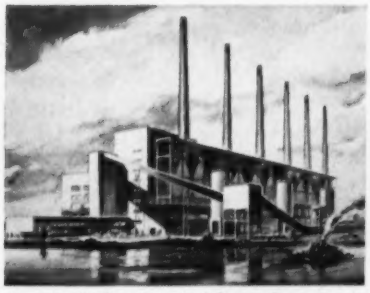
Send for copy of reprint, "Try the Gradiation Heater for Economical Ethylene Production" and Bulletin 1110 "Gradiation Heating for Petroleum and Chemical Processing."

SELAS
CORPORATION OF AMERICA
DRESHER, PENNSYLVANIA

Heat and Fluid Processing Engineers
DEVELOPMENT • DESIGN • CONSTRUCTION

Anaconda tubes of Arsenical Admiralty-439 in the process of being installed in the exhaust condenser at River Rouge.

Nation's largest exhaust condenser at new 260,000-kw T. G. River Rouge Plant uses Arsenical Admiralty Tubes



Sketch of The Detroit Edison Company's great River Rouge generating plant as it will look when completed. Sketch shows the ultimate 6-unit plant; only 3 units are being constructed at this time.

When the Detroit Edison Company's new River Rouge plant was placed in operation recently, the exhaust condenser of its 260,000-kw first unit became the largest in the country.

This huge Allis-Chalmers condenser has a total cooling surface of 115,000 square feet. The American Brass Company supplied 19,850 tubes of Arsenical Admiralty-439, each ¾" O.D. by 0.049" (18 BWG) by 30' long—for a total weight of approximately 250,000 pounds.

The American Brass Company is constantly studying corrosion problems affecting condensers and heat exchangers—and is a leader in the development of alloys to help meet these problems. Arsenical Admiralty-439 is but one of its many contributions in the field.

The metallurgical engineers and sales representatives of The American Brass Company are available to help you in the selection of the Anaconda Condenser Tubes to meet your specific needs. Write: Technical Department, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA®

TUBES and PLATES for CONDENSERS and HEAT EXCHANGERS

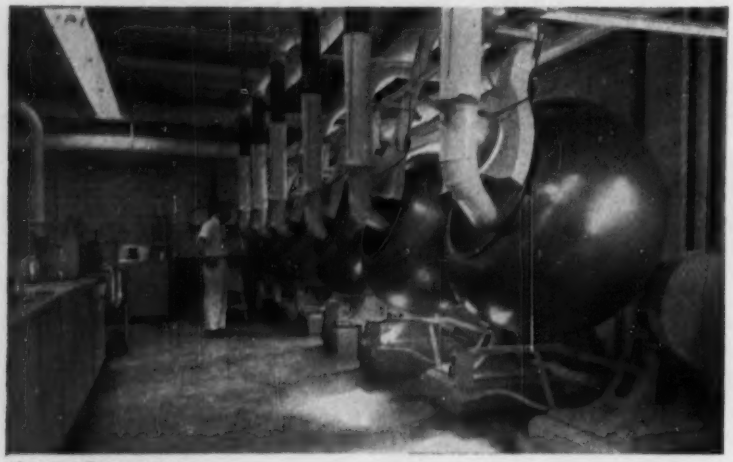
COOLED

for employee comfort and

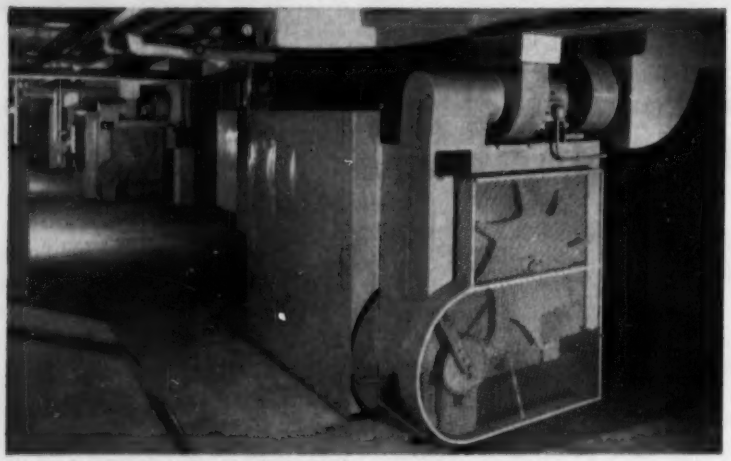
DEHUMIDIFIED

for product safety

Pharmaceutical Building



Coating Department



These three air-drying Lectrodryers make operations independent of outside weather conditions.

The three Type CH Lectrodryers* that dehumidify work areas here are kept running even when cooling equipment is shut down. Because moisture seeps in fast if the humidity is high out-of-doors, G. D. Searle & Co., Chicago, take no chances on moisture build-up to impair the high quality of their pharmaceutical products.

Lectrodryers, on the job here ever since Searle moved into this ultra-modern plant in 1949, make them independent of damp Chicago weather.

An interesting observation bearing on the future of comfort conditioning systems is this fact: Employees working in areas of equal temperatures find the dehumidified areas much more comfortable. Some day Lectrodryers will be standard equipment in comfort-conditioning.

Whatever your problem with unwanted moisture, get in touch with Lectrodryer. The book, Because Moisture Isn't Pink, describes many DRYing installations. Pittsburgh Lectrodryer Company, 303 32nd St., Pittsburgh 30, Pa., (a McGraw Electric Company division).

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

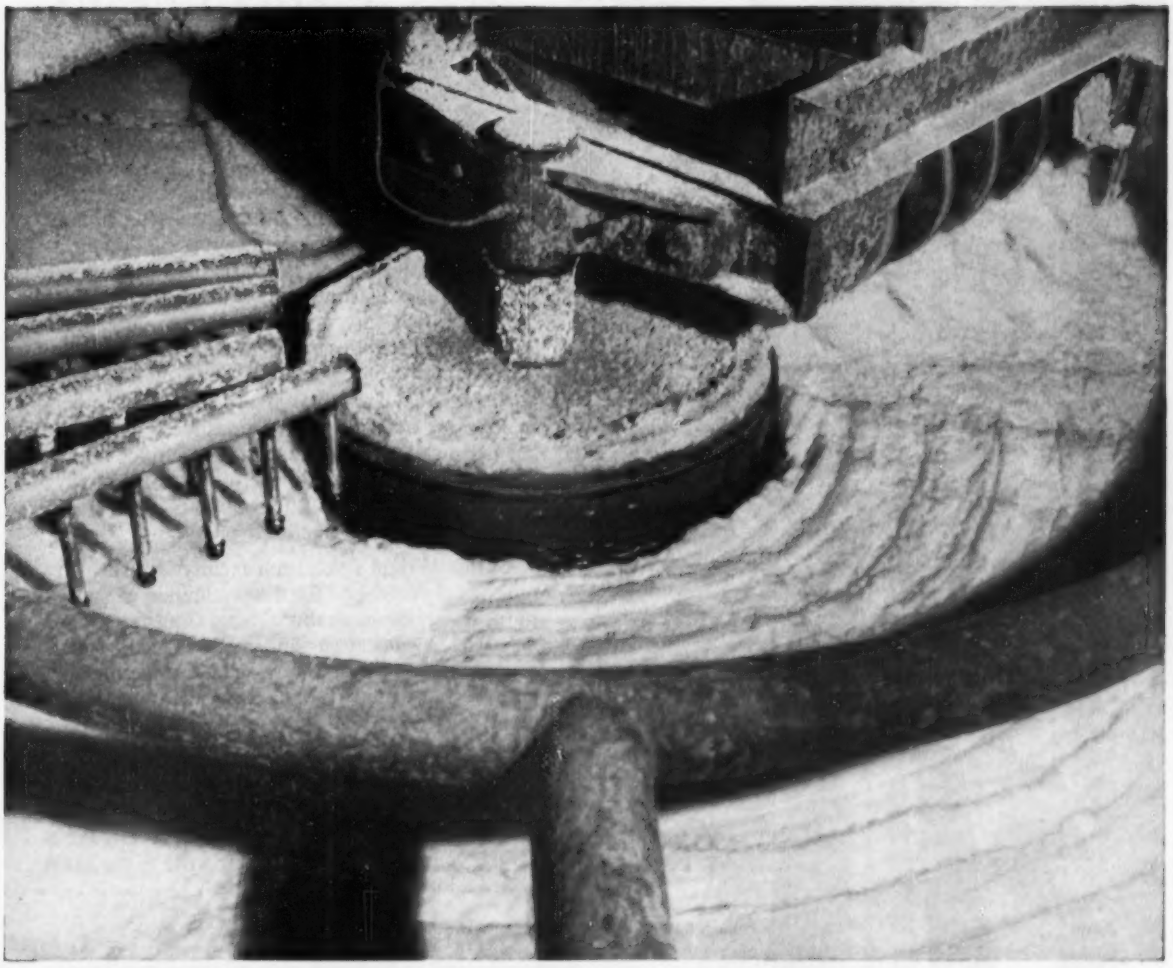
LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

West End doubles capacity of sodium sulfate plant

Acceptance of West End Sodium Sulfate has spread so rapidly that we are enlarging our plant to produce over 100,000 tons a year. Even at this rate we are tapping less than 50% of our natural raw material supply. This output and reserve provides industry with a dependable source of highest quality sodium sulfate to serve its growing needs. Samples, prices and freight schedules will be submitted gladly on request. Please include specifications.

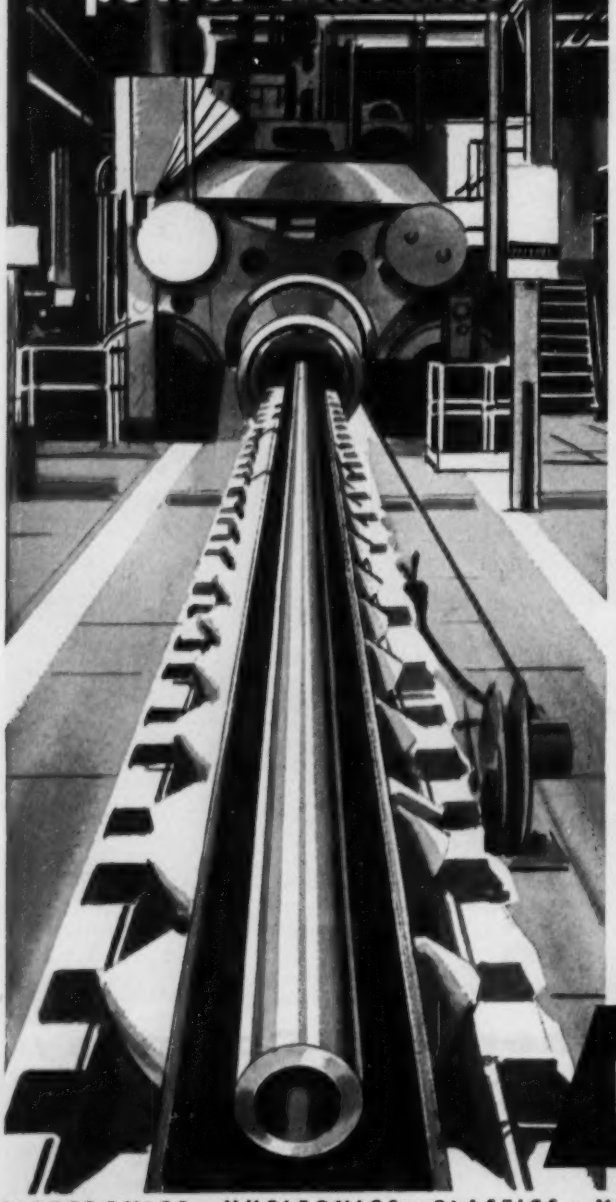


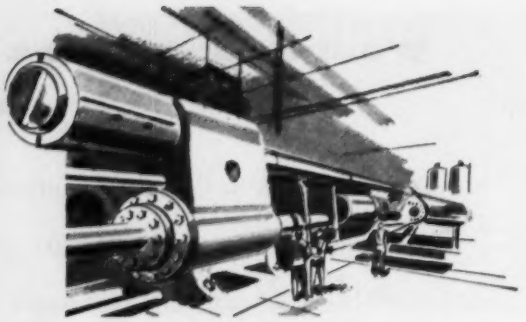
WEST END **West End Chemical Company**

SODA ASH • BORAX • SODIUM SULFATE • SALT CAKE • HYDRATED LIME

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIFORNIA • PLANT, WESTEND, CALIFORNIA

For longer life, higher performance in the petroleum, chemical and power industries





Corrosion-Resistant, Heat-Resistant EXTRUDED Steel Pipe

Curtiss-Wright's Metals Processing Division now offers the petroleum, petrochemical and power industries a line of high-quality, extruded steel tubular products to meet the most severe demands of modern processing. Inherent corrosion and heat-resistant properties of the steel alloys used are amplified by extrusion because the finished tube is produced with only one heat, in one pass of the giant 12,000 ton press . . . formed under compression in a matter of seconds without seams, in lengths up to 50 feet. Extra margins of resistance to corrosion and heat are built in easily by extruding heavier pipe wall thicknesses at no sacrifice in production speed. The most up-to-date quality control facilities, including ULTRASONIC TESTING, are employed in production.

Curtiss-Wright's extrusion facility is a specialty mill, ideally equipped for the production of special purpose, premium quality tubing. Conformance to A.S.T.M. specifications and other exacting standards is assured by an experienced engineering staff and the most modern metallurgical testing equipment.

When higher pressures and temperatures, or more corrosive service conditions demand more than the ordinary in large diameter pipe, let Curtiss-Wright serve you through the nearest Metals Processing Division Branch Office, or write to the Main Office address shown below.

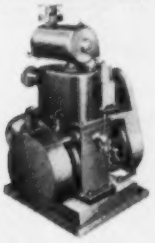
75 Grider Street, Buffalo, New York

METALS PROCESSING DIVISION
CURTISS-WRIGHT CW
CORPORATION • BUFFALO, NEW YORK

ELECTRONICS • NUCLEONICS • PLASTICS • METALLURGY • ULTRASONICS • AVIATION

SAVE MAN-HOURS WITH HIGH VACUUM COMPONENTS MADE BY MEN WHO USE THEM

Mechanical Vacuum Pumps



NRC Model 100M

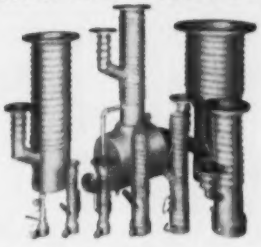
Because of the Gas Ballast feature, these pumps maintain their original high efficiency even when pumping 100% water, or other condensable vapors. Therefore, expensive oil purifiers and frequent and costly oil changes are not needed. NRC pumps have paid for themselves in three years from oil savings alone.

Model	Capacity CFM	Ultimate Vacuum Gas Ballast Off mm. Hg (A)	Ultimate Vacuum Gas Ballast On mm. Hg (A)	Price (B)
SINGLE STAGE				
2-S	1.25	3×10^{-3}	Less than one half millimeter of mercury	$155
4-S	3.3	3×10^{-3}		225
6-S	6.75	3×10^{-3}		312
15-S	11.6	3×10^{-2}		475
30-S	29.5	3×10^{-3}		800
100-S	100	3×10^{-3}		1475
200-S	202	1×10^{-2}		2500
400-S	403	5×10^{-3}		3875
DOUBLE STAGE				
2D	1.25	5×10^{-5}	2.5×10^{-2}	$215
4D	3.3	5×10^{-5}	2.5×10^{-2}	280
6D	6.75	5×10^{-5}	2.5×10^{-2}	425
15D	14.75		2.5×10^{-2}	750
30M	29.5	3×10^{-3}	3×10^{-3}	1200
100M	100	3×10^{-3}	3×10^{-3}	1975
200M	202	3×10^{-3}	3×10^{-3}	3200
400M	403	3×10^{-3}	3×10^{-3}	5425

Note A: McLeod gauge reading

Note B: F.O.B. Newton, Mass. Price includes pump, base, v-belt drive, and motor

Diffusion and Booster Pumps



NRC Booster and Diffusion Pumps

While NRC high vacuum diffusion and booster pumps are unsurpassed for through-put, blank off, and forepressure tolerance, they are especially outstanding for reliability. They offer long, trouble-free life, and are easy to maintain. Narcoil pumping fluids are unusually stable, have excellent pumping characteristics, and are low-priced. Narcoil-10 is $10.50 per gallon and Narcoil-40 is $38.50 per gallon.

Model	Blank-Off, mm. Hg (C)	Max. Speed Liters/Sec.	Tolerable Forepressure mm. Hg	Pumping Fluid	Price (D)
DIFFUSION PUMPS					
G-2-M (A)	8×10^{-7}	30	0.50	Mercury	$225
H-2-P	2×10^{-7}	80	0.25	Narcoil 40	125
A-2-P (B)	2×10^{-6}	85	0.20	DC 703	150
H-4-P	5×10^{-7}	300	0.31	Narcoil 40	245
H-6-P	5×10^{-7}	730	0.20	Narcoil 40	410
H-10-P	5×10^{-7}	1900	0.19	Narcoil 40	745
H-16-P	5×10^{-7}	5500	0.30	Narcoil 40	1320
BOOSTER PUMPS					
B-1	1×10^{-4}	8	0.30	Narcoil 10	$ 65
B-2	1×10^{-4}	85	0.85	Narcoil 10	195
B-4	1×10^{-4}	260	1.30	Narcoil 10	355
B-6	1×10^{-4}	530	0.90	Narcoil 10	990
B-12	1×10^{-4}	3500	0.90	Narcoil 10	on request

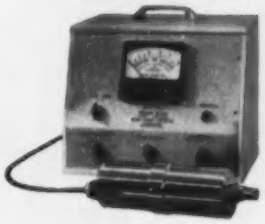
Note A: Glass pump

Note B: Air-cooled. Price includes blower

Note C: Untrapped ion gauge, except for G-2-M

Note D: Includes initial charge of pumping fluid

Vacuum Gages



NRC Model 520

NRC vacuum gauges are outstanding for their accuracy and ability to withstand hard usage. The NRC Model 520 shown above is an all-purpose gauge with uniquely wide range and accuracy. Its ruggedized new circuitry eliminates troublesome components, minimizes contamination effects and provides highly stable linear amplification.

Model	Type	Range mm. Hg	Price complete with head(s)
NRC HIGH VACUUM GAUGES			
501	Thermocouple Head	10^{-3} to 1.0	$10.50
507	Ionization Head	2×10^{-8} to 5×10^{-3}	22.00
510	Alphatron® Ionization	10^{-3} to 10.	520.00
515	Logarithmic Alphatron® Ionization	10^{-3} to 10.	250.00
561	Pirani	10^{-3} to 1.0	175.00
520	Alphatron® Ionization	10^{-4} to 10^{3}	550.00
701	Thermocouple	10^{-3} to 1.0	130.50
710	Thermocouple Ionization	2×10^{-8} to 1.0	438.00

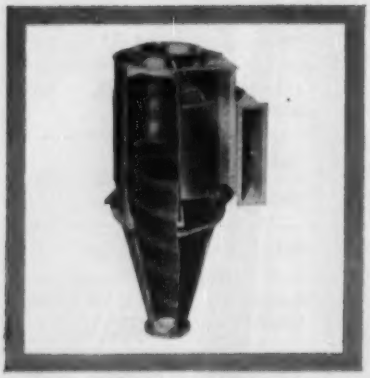
As a pioneer in the manufacture and use of high vacuum systems, NRC learned well what unreliable components can cost in wasted time and money. Offered above are components developed by NRC to meet its high operating standards. To get further information send coupon.

NRC
EQUIPMENT
CORPORATION

NRC EQUIPMENT CORPORATION
A Subsidiary of
NATIONAL RESEARCH CORPORATION
Dept. 510, Charlemont Street, Newton Highlands 61, Massachusetts
Please send NRC Bulletins on Mechanical Pumps ☐; Diffusion and Booster Pumps ☐; Vacuum Gauges ☐
Have representative call ☐
Name..... Title.....
Company.....
Address.....
City..... Zone..... State.....

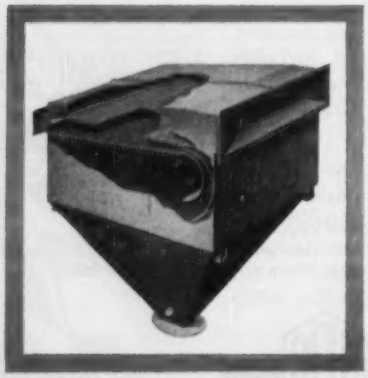
How Buell's Exclusive Rapping Mechanism delivers Extra Dust Collection Efficiency

ORDINARY RAPPING
Shakes dust from collecting electrodes. Re-entrainment of cloud of dust reduces precipitator efficiency
BUELL RAPPING
Shears dust from collecting electrode surface, minimizes scattering and re-entrainment



Buell Cyclones offer two "extra-efficiency" advantages: (1) exclusive Shave-off which harnesses double-eddy and puts it to work, and (2), large diameter design which eliminates clogging.

Complementing the extra efficiency of rapping in Buell "SF" Electric Precipitators, the unique Spiralectrodes add further efficiency through 50% to 100% higher electron emission, constantly accurate spacing, longer electrode life.



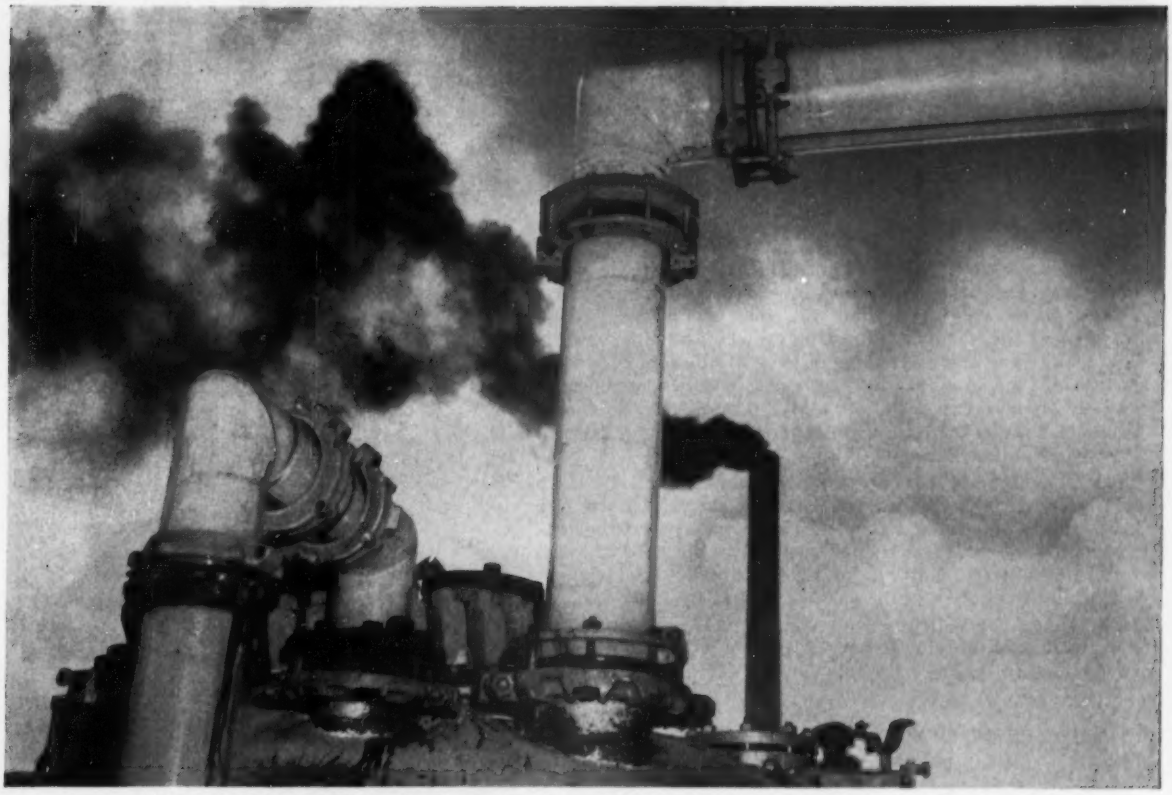
Buell's Low Resistance Fly Ash Collector combines top efficiency with low draft loss, for natural or forced draft installations. Ideal for boilers from 100 to 2000 BHP.

For more specific data about Buell's *extra efficiency*, write Dept. 12-J, Buell Engineering Company, 70 Pine Street, New York 5, N. Y.

buell®

MECHANICAL ELECTRICAL

Experts at delivering Extra Efficiency in **DUST COLLECTION SYSTEMS**



PYREX pipe does a superior job handling such acids as sulphuric, hydrochloric, nitric and acetic; and such materials as chlorinated hydrocarbons, hydrogen peroxide, bromine, brines and metallic salts of all concentrations.

See how this glass pipe stands up to one of the toughest corrosives of all

This Crosby Chemical Co. case history, involving the successful handling of extreme corrosives, may help you cut corrosion in your plant.

At its DeRidder, La. plant, Crosby pipes chlorinated resins at 15″ Hg vacuum. Temperatures are 70° to 250°F.

With conditions like these, you could reasonably expect frequent pipeline replacement, high maintenance costs—and all the other usual problems you face in handling severe corrosives.

Yet Crosby's lines have been in service 3 years. Scaling is nonexistent. They've never been cleaned. Maintenance costs hardly exist. Reason: they're PYREX *brand "Double-Tough" glass pipelines.*

So well pleased are the Crosby folks with glass pipe performance, they now use it in a new plant at Picayune, Miss.

Name your corrosive

You can transfer just about any corrosive you handle today—or will handle in the future—in corrosion-proof glass pipe. Only exceptions are hydrofluoric acid and hot concentrated alkalies.

And this same chemical inertness may give you still another important reason to choose glass. *Glass pipe neither adds to nor takes from sensitive fluids.* You can end contamination with it. It puts an end to metal pickup.

What about pressure, temperature?

If you have to pipe hot fluids and fluids under pressure, you can go up to 50 lb. psi in smaller size pipe and to 20 lb. psi in the 6″ size. Temperatures can vary from below 0°F to 250°F.

When you install PYREX brand glass pipe in your plant, you'll be joining hundreds of other firms who have used it for as long as 30 years. You'll start immediately to collect the savings that come whenever you cut corrosion out of a process.

Help close by

Near you is a distributor of PYREX brand pipe. He'll be glad to help you evaluate its place in your plant. At your convenience, he'll arrange for you to see an actual installation.

For his name, and for detailed information, send us the coupon today.

CORNING GLASS WORKS, 110 Crystal St., Corning, N. Y.

Please send me more detailed information on PYREX brand "Double-Tough" glass pipe ☐; send name of nearest PYREX pipe distributor ☐.

Name..... Title.....

Company.....

Street.....

City..... Zone..... State.....

Traylor Rotary Kilns

help you realize both . . .

HIGHER PRODUCT QUALITY

LOWER PRODUCTION COST

Wherever you find a sizeable thermo-processing operation, chances are you'll find a Traylor Rotary Kiln at work improving product quality and lowering production costs. Today there are more than 175 Traylor Rotary Kilns engaged in the calcining, roasting and chloridizing, volatilizing, sintering and nodulizing of over 20 different products. Many of the major improvements that have become accepted standards of modern kiln design are the direct result of Traylor's engineering experience and leadership in Rotary Kiln development.

With Traylor's 50 years' experience, chances are they have "Traylor-Made" a Rotary Kiln quite similar to the one best suited for more efficient and profitable thermo-processing of your particular product. Sizes have been built from the smallest up to 12′ in diameter and 450′ in length.

Bulletin #1115 will give you complete specifications and descriptions of Traylor Rotary Kilns. Write for your copy of this helpful booklet today. A copy is yours on request.

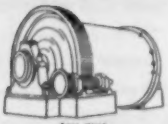
TRAYLOR ENGINEERING & MANUFACTURING CO.
844 MILL ST., ALLENTOWN, PA.
SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfr: Canadian Vickers, Ltd., Montreal, P. Q.

A Traylor leads to greater profits

PRIMARY GYRATORY CRUSHERS

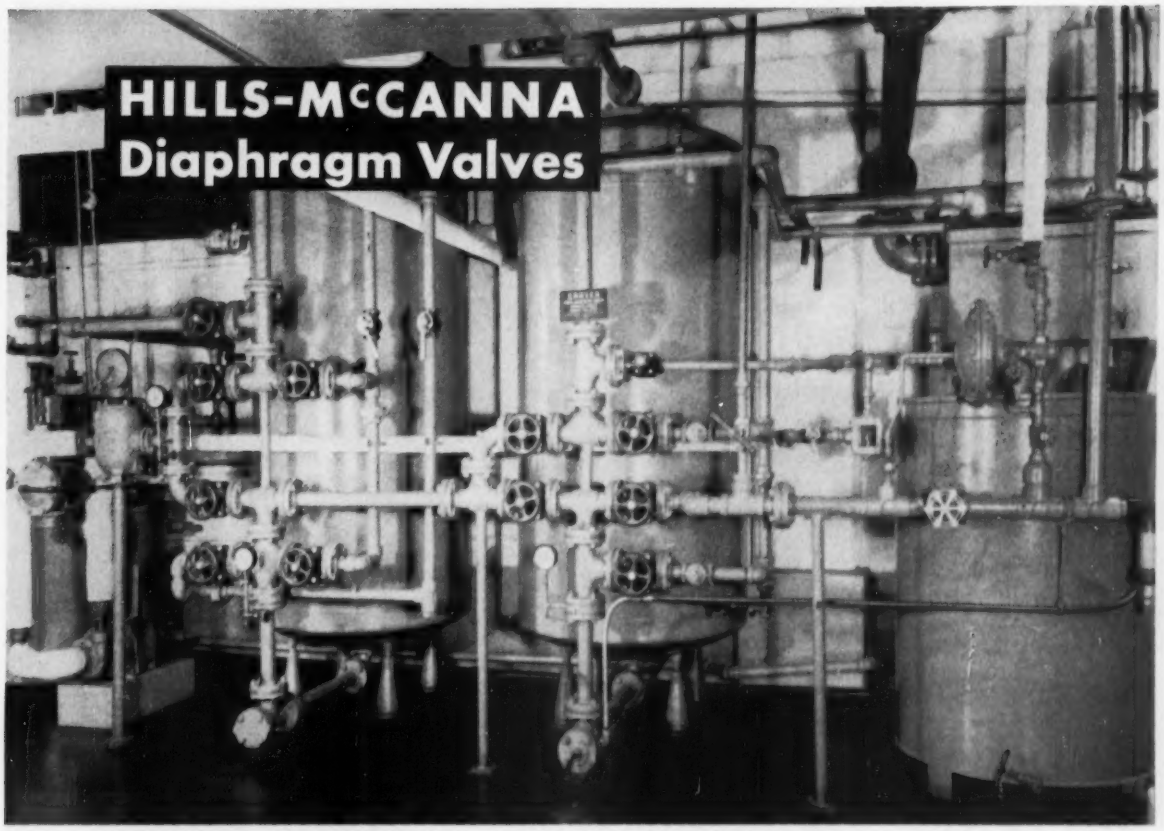
ROTARY KILNS

SECONDARY GYRATORY CRUSHERS


BALL MILLS

JAW CRUSHERS

APRON FEEDERS



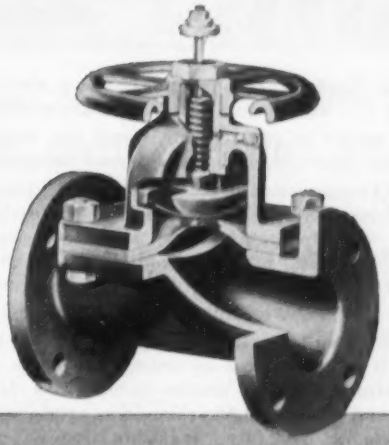
Meet All Five Critical Requirements of this Two-bed Demineralization System

Concentrated and dilute acids and corrosive liquids are handled effectively and dependably by Hills-McCanna Diaphragm Valves in this Graver ion exchange demineralizer. And the Hills-McCanna valves meet all five critical requirements of the system:

System Requirement	Hills-McCanna Solution
Corrosion Resistance	Plastic or plastic lined bodies* plus the patented Hills-McCanna diaphragm prevent contact between corrosive solution and metal parts of the valve.
Leaktight Closure	Hills-McCanna beaded diaphragm construction provides controlled, cushioned, "pinch-clamp" closure.
Minimum Head Loss	Streamlined flow passage of Hills-McCanna valves has no sharp changes of direction.
Easy Maintenance	No packing to take up or replace. Only maintenance required is occasional diaphragm replacement, accomplished without removing valve body from line.
Easy Adaptability to Automatic or Remote Operation	Hills-McCanna valves are used with virtually all types of operators.

*Also available in a wide choice of other corrosion-resistant materials.

If you valve hard-to-handle fluids, your problems are probably similar to these. You, too, can solve them with Hills-McCanna Diaphragm Valves. For further information, write for Bulletin No. 100.



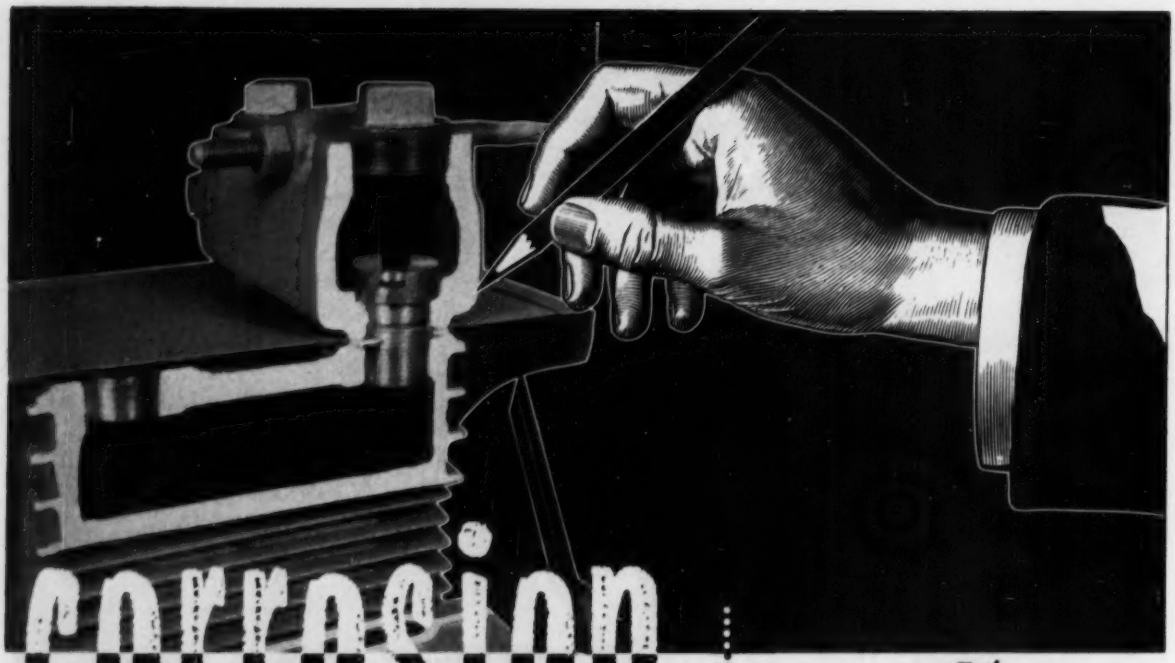
...HILLS-McCANNA...

Corrosion Specialists Since 1870

HILLS-McCANNA CO.

2341 W. Nelson St. Chicago 18, Illinois

Manufacturers of: Diaphragm Valves • Chemical Metering and Proportioning Pumps • Force Feed Lubricators • Light Alloy Castings



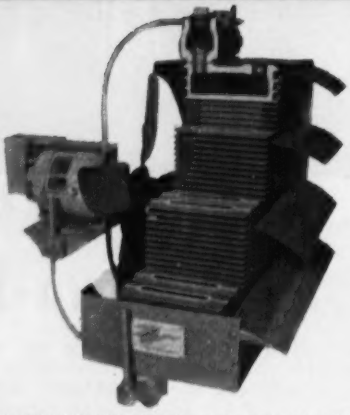
corrosion

EXTERNAL - from contaminated air

INTERNAL - from electrolytic action

ends

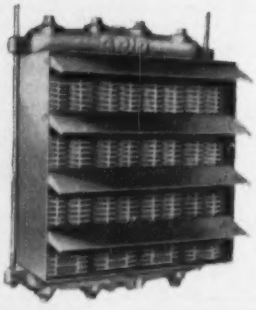
When your UNIT HEATERS are GRID CAST IRON CONSTRUCTION - and HERE'S WHY -



GRID heating sections and headers are made of high-test cast iron . . . no external corrosion from acid fumes.

All metals in contact with steam are similar . . . no electrolytic action internally . . . no internal corrosion.

GRID construction ends your unit heater maintenance problems—because GRID will operate on steam pressures up to 250 lbs. P.S.I. . . . 450° temperature . . . no pressure-reducing valves needed. No soldered, brazed, welded or expanded connections . . . a specially designed threaded nipple provides a leak proof joint (see illustration).



GRID design gives you maximum heating performance because—

GRID provides more air changes at lower outlet temperatures . . . carefully selected motor speeds and fan capacities positively deliver warm, comfortable air in ample volume to floor level . . . no wasted heat through stratification.

GRID installations save you money as GRID requires no maintenance . . . is practically self-cleaning (note wide fin spacing in illustration). GRID provides long service life . . . units installed in 1929 are still operating. No ordinary unit heater approaches GRID's record for continuous trouble-free heating service.

Get the complete story on GRID Unit Heaters, GRID Blast Heaters and GRID Radiation for chemical plant use. Write for your copy today!

D. J. MURRAY MANUFACTURING CO.

Manufacturers Since 1883 • WAUSAU, WISCONSIN

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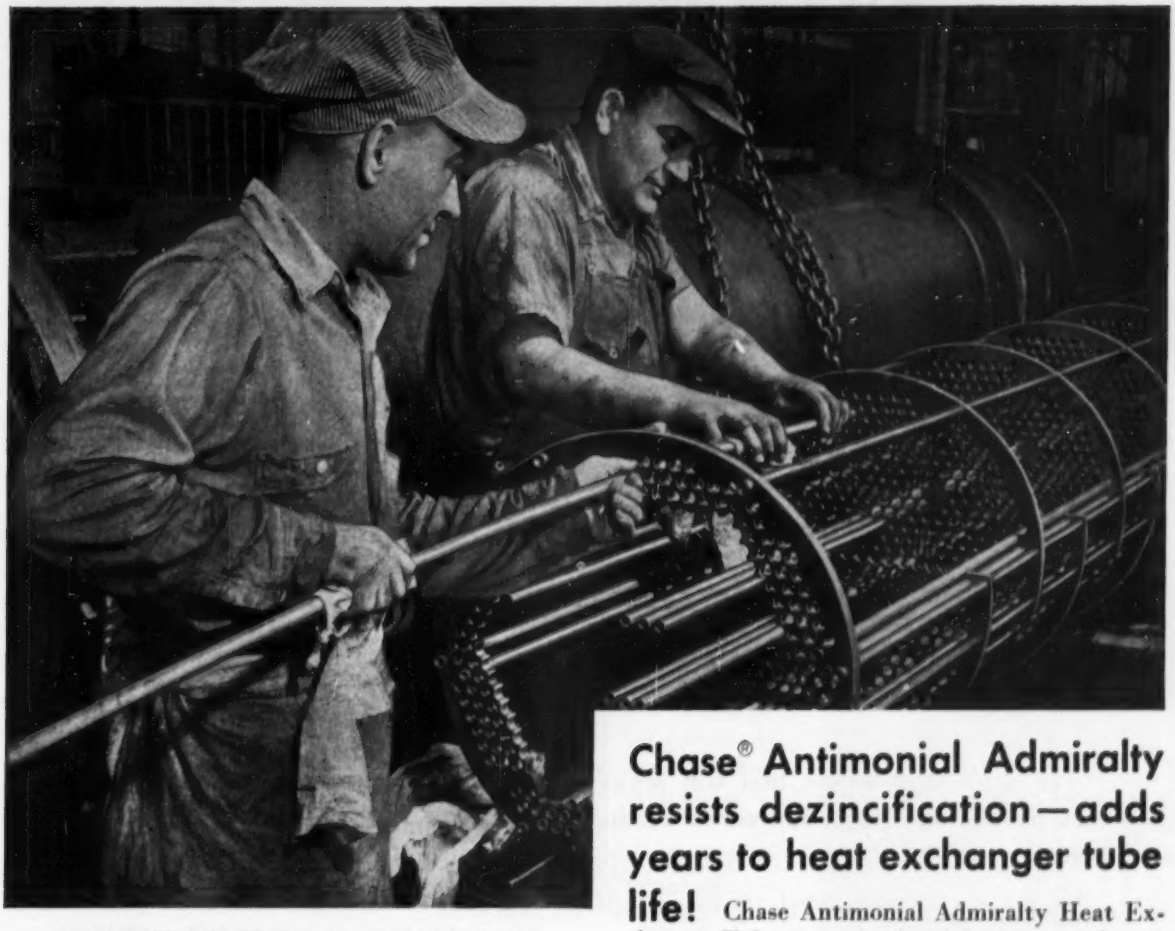

Chase® Antimonial Admiralty resists dezincification—adds years to heat exchanger tube life! Chase Antimonial Admiralty Heat Exchanger Tubes contain the *right* amount of antimony needed to resist dezincification and other forms of corrosion. That's why *Chase* tubes last so much longer!

And antimony will *not* weaken the tube in other ways! That's why *Chase* tubes *stay* sound through years of adverse conditions in the field!

When you replace Heat Exchanger Tubes, or plan a new installation, get the benefit of *extra* years of service. Insist on Chase Antimonial Admiralty.

Learn more about corrosion problems, and how Chase can help solve them. Send for free Chase Condenser and Heat Exchanger Tube Booklet.

CHASE WAREHOUSE STOCKS: Beaumont,* Houston,* Los Angeles, New Orleans, Tulsa**

*Handled by Standard Brass & Mfg. Co.
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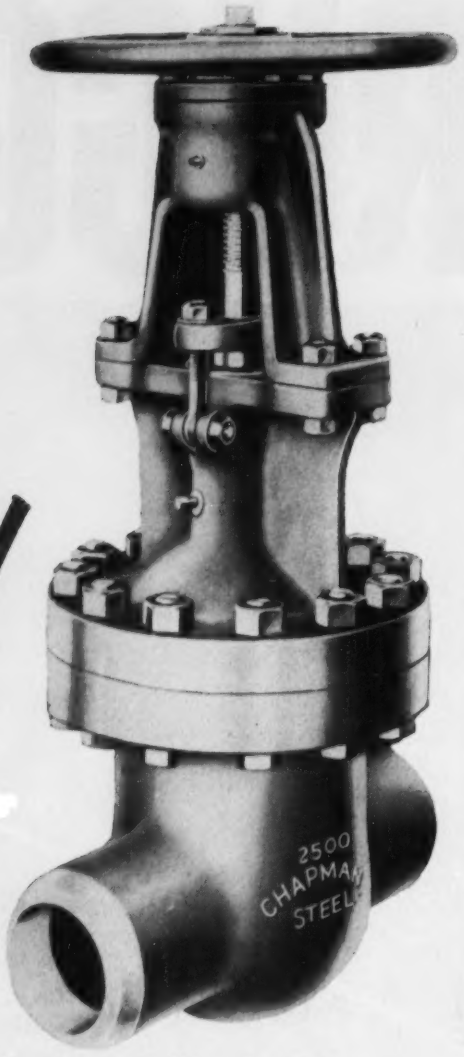
Chapman Steel Valves

Have It!

EVERYTHING YOU NEED



You want steel valves that will prove their metal under tough and varied conditions.

Chapman has them. Steel valves . . . in many different alloys . . . all carefully formulated and poured under rigid supervision in Chapman's own foundry.

You want steel valves with the smoothest operation for years of rugged service.

Again, Chapman has them. Valves that seat tightly, accurately, permanently. Valves that don't jam, chatter or wear excessively. Valves with the closest possible tolerances.

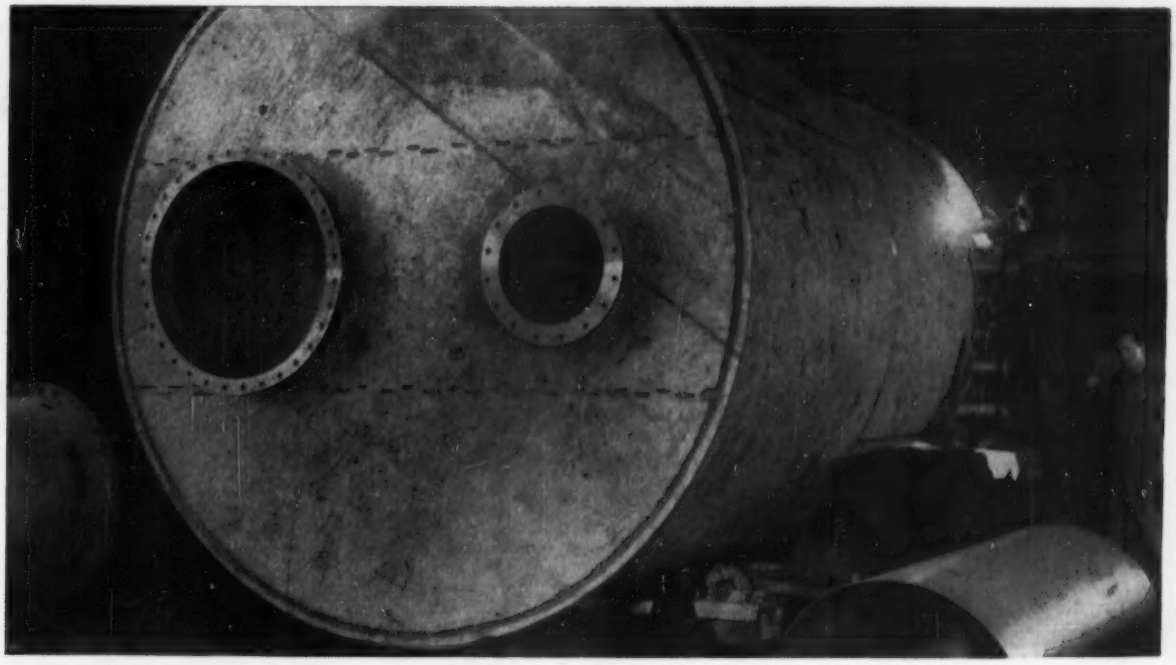
Just name your steel valve requirements. Pressure and temperature for any specified operating condition are met as you want them with Chapman Steel Valves. This includes Chapman welded, pressure seal, bolted bonnet, or valves of special design.

They all equal or exceed A.S.A. and A.P.I. standards. They all cut maintenance costs to a new low.

For your own sake and convenience, get a copy of Chapman Catalog 20 now.

THE CHAPMAN VALVE MANUFACTURING CO.

INDIAN ORCHARD, MASSACHUSETTS



ARMCO ELC STAINLESS

Keeps this Ammonium Nitrate Neutralizer "On Stream"

Reaction from $NH_3 + HNO_3$ has no adverse effect on this neutralizer made of Armco Stainless Steel Type 304 ELC. The reason is that all weld areas have the same corrosion resistance as the rest of the unit. The extremely low carbon content (0.03% max.) of Armco ELC Stainless prevented harmful carbide precipitation during fabrication and erection.

Armco ELC assures corrosion resistant welds without troublesome post-weld annealing, or the use of costly stabilized stainless grades. It also means that modifications of the neutralizer can be made in the field without danger of intergranular corrosion due to welding.

Armco offers you two extra-low carbon stainless grades, Type 304 ELC and Type 316 ELC can be used in the as-welded condition at temperatures up to 800 F. Both grades are available in sheets, strip, plates, bars and wire.

Why not give *your* processing equipment the low-cost, corrosion-safety factor that comes with Armco ELC Stainless Steel. For complete information on these money-saving special Armco Stainless Steels, just fill out and mail the coupon.

Armco Steel Corporation
2016 Curtis Street, Middletown, Ohio

Send me a copy of the booklet "Armco's ELC Stainless Steels."

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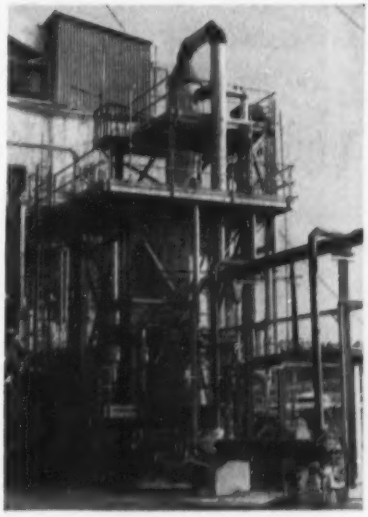

This 120 in. diameter Type 304 ELC stainless steel neutralizer is now "on stream" in a southern ammonium nitrate fertilizer plant. Welding includes some 30 pipe connections and baffles.

ARMCO STEEL CORPORATION
2016 Curtis Street, Middletown, Ohio

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

NO MEASURABLE ERROR IN A 5 OERSTED FIELD!

Model 325 self-shielded D-C Laboratory Standard (1/10 of 1%)—an improved instrument now replacing the world renowned Model 5.

The new Weston model 325 provides a new STANDARD of laboratory measurement

Another WESTON first... a self-shielded primary instrument standard that is unaffected by magnetic fields normally encountered in the modern laboratory. While the new Model 325 incorporates a special CORMAG® mechanism, the overall design provides an even far greater degree of shielding than that inherent in the basic core-magnet mechanism. In fact, tests show absolutely no measurable error in a 5 oersted field. Thus there is no need for positioning or mounting the instrument with reference to the earth's field; nor to take undue precautions when using it in close proximity to current carrying conductors. In addition, Model 325 is well compensated for normal room temperatures; and a vernier type corrector is provided for precise and rapid zero adjustment. This improvement in primary instrument standards is another example of the *forward thinking* and *continuous development* which have kept WESTON the instrument leader since 1888. For complete data on Model 325, or on other Weston instruments consult your nearest Weston representative, or write... *Weston Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, N. J.* A subsidiary of Daystrom, Incorporated.

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U.S.I. CHEMICAL NEWS

October ★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1956

U.S.I.'s 50-YEAR HISTORY PARALLELS INDUSTRIAL CHEMICAL GROWTH IN U.S.

First Organized to Serve Industrial Alcohol Users; Company Later Expanded to Produce Alcohol-Based Chemicals Present Growth Aimed at Wide Diversification

The Denatured Alcohol Act passed by Congress on June 7, 1906 was a historic piece of legislation. By freeing industrial alcohol from the taxes applied to beverage spirits, it set the stage for an unprecedented expansion of the chemical industry.

Four months after passage of the act, on October 17, 1906, the organization known today as U. S. Industrial Chemicals Co. was formed to serve industrial users of alcohol under the new law.

Leader in Alcohol

By 1916, through construction and acquisition, U.S.I. had become the leading producer of industrial alcohol in the country. In that year the company came onstream with what was then the world's largest and most modern alcohol plant. This plant doubled U.S.I. capacity in a single year.

A sound sales organization already existed, based upon the acquisition in 1915 of the famous House of Webb, largest alcohol distributors in U. S. at that time.

World War I precipitated U.S.I. into the chemical business. In 1916 a plant went up at Fairfield, Baltimore to produce acetone from ethyl alcohol to meet British war requirements. Other chemicals from ethanol were soon forthcoming — materials first produced in this country as a result of research carried on in U.S.I. laboratories from 1916 to 1925. During the 1930's and 40's the company began production of butyl alcohol and derivatives and scored a number of advances in insecticide and resin technology. U.S.I. also pioneered the production of synthetic DL-Methionine, an important sulfur bearing amino acid, used in pharmaceuticals and for animal nutrition.

Rapid Growth Since 1950

In 1951, U.S.I. merged with National Distillers, whose subsidiary, National Petro-Chemicals Corporation, was then building at Tuscola, Illinois a huge synthetic ethyl alcohol plant. Until that time, all alcohol U.S.I. made was produced by fermentation. Now with the industrial alcohol capacity of the Tuscola plant equal to 25% of the na-

MORE

ATTENTION

Users of Taxfree and Specially Denatured Alcohol

Now is the time for users of specially denatured alcohol to renew their basic permit (Treasury Department Form 1479) for 1957. It is also time for users of taxfree alcohol to complete and file with the Assistant Regional Commissioner — Alcohol and Tobacco Tax Division — their application (Form 1450) for renewal of their taxfree Alcohol permit for 1957.

It is recommended to permittees who withdraw industrial alcohol in drums that total gallonage of renewal permits be calculated to cover withdrawals in multiples of 55. If you require renewal forms or any assistance in their preparation, please call your nearest U.S.I. office.

U.S.I. to Build New Titanium Sponge Plant

Plans to construct a new plant for production of 10 million pounds per year of titanium sponge have been announced by U.S.I. Location of the plant will be Ashtabula, Ohio, site of U.S.I.'s sodium plant and the U.S.I. zirconium sponge plant now under construction.

High-quality titanium sponge will be produced by a new sodium reduction process similar to the one planned for production of zirconium sponge. Use of the new process is said, by U.S.I. officials, to produce a higher purity titanium sponge than the conventional magnesium reduction process at a lower cost than any existing commercial technique. Output of the new plant will be sold to commercial users. It was pointed out by Dr. R. E. Hulse, Vice President of National Distillers in charge of Chemical Operations, that this is the first titanium plant to be built without a government procurement guarantee.

Titanium metal has a great potential, especially in the aircraft industry, because of its high strength-weight ratio. Its excellent corrosion resistant properties also make titanium a promising material of construction for many chemical processing applications.

New York's Broadway at Canal Street in 1835 — "Webb's Emporium of Light" on the corner specialized in alcohol lighting fuels, later became a leading distributor of alcohol for industrial and scientific use. The firm was acquired by U.S.I. in 1915 and formed the nucleus of the present U.S.I. sales organizations.

October ★ **U.S.I. CHEMICAL NEWS** ★ 1956

CONTINUED

50 Years

tion's previous output, U.S.I. continues to use the fermentation process only at its Anaheim, California, and New Orleans plants.

The merger also made U.S.I. a large scale producer of sodium, sodium peroxide and chlorine. Within the past three years, new plants have been completed for production of ethyl chloride, polyethylene, ammonia, and sulfuric acid. Other plants, built or acquired, added caustic-chlorine facilities to the growing list and increased sulfuric acid capacity. Now under construction or on the drawing boards are four new plants to produce phosphoric acid, sebacic acid isomers, zirconium sponge and titanium sponge. Polyethylene capacity meanwhile is being almost doubled.

This month, at 50, U.S.I. is still expanding with youthful vigor—still looking ahead—to new products new methods, new services for a mushrooming chemical industry.

Urethan Increases Enzyme Activity

Working with guinea pigs, European researchers found that urethan produced an increase in enzyme activity of ribonuclease, cytochrome, lactic dehydrogenase, succinic dehydrogenase.

Method for Coating Drums With Polyethylene Revealed

A new patent describes a process for lining steel drums with polyethylene, in thicknesses claimed to be greater than previously possible on a commercial basis. In the new technique, powdered resin is tumbled through preheated drums, where the hot metal fuses the polyethylene into a smooth, continuous lining. Thicknesses of 8 to 30 mils can be deposited, depending on the end use.

The drum is first preheated to a temperature high enough to remain above the melting point of polyethylene throughout the entire lining operation, yet low enough to avoid charring the resin.

Polyethylene powder is then tumbled through while the drum is rotated. An excess of powder acts as an insulator to retard cooling, while its weight serves to consolidate softened particles into the coating.

U.S.I. Now Lends Pilot Unit to Customers to Make Sodium Dispersions

U.S.I. has designed and built a pilot plant unit which it will lend to interested researchers for preparation and evaluation of sodium dispersions at point of use.

The unit has a batch capacity of three gallons of dispersion – finely divided sodium suspended in inert hydrocarbon medium. A number of companies have already taken advantage of this U.S.I. service to speed development of their experimental projects.

Since the unit is fabricated from readily available parts, identical or larger units can be constructed easily by companies considering long term studies. U.S.I. Technical Service people will provide the design information necessary for fabrication of such units.

TECHNICAL DEVELOPMENTS

A completely new scintillation detector for efficient gamma ray counting is now available. Designed for labs where gamma-emitting radioactive isotopes are used. Operates with either sodium iodide or scintillation well crystals. **No. 1170**

Sebacic acid isomers are described in technical data sheet. New mixture of 10-carbon dibasic acids reported promising as intermediate for plastics, plasticizers, and synthetic lubricants. **No. 1171**

Ten-year index to corrosion can now be purchased, covering 629 articles published from 1945-54. Contains subject, author and title indices, many tables of data. Subject matter range is wide. Much on pipelines, petroleum. **No. 1172**

A new adhesive binds polyethylene to chip and kraft board in making packaging envelopes and polyethylene laminated bags and boxes. Claimed to have excellent shock resistance and aging qualities. Will not crystallize. **No. 1173**

Antioxidant for animal and poultry feeds helps pigmentation and prevents loss of such vitamins as A and E. Also protects palatability of feeds by stabilizing the natural oils. Use in animal feeds follows several years' use as antioxidant in foods. **No. 1174**

A specially processed seawater magnesia for catalysis and absorption is now on the market. Claimed to be only commercial material to combine high surface area, uniformly large pores, mechanical strength, with high basicity, ionic crystal structure. **No. 1175**

A biologically stable casein solution for stabilizing, thickening and leveling latex and emulsion paints has just been developed. Reported resistant to spoilage indefinitely. **No. 1176**

A sodium brochure on handling the metal on a plant scale is now available. In 40 pages it covers: properties and uses; equipment construction, design and operation; handling procedures; safety measures. **No. 1177**

Handling of flammable liquids, along with their characteristics and hazards, is discussed in a new series of safety bulletins. Parts I and II have already been issued. Part III to come soon. Binder provided for filing all issues. **No. 1178**

King-size Waring Blendor that holds one gallon now obtainable. Gives choice of 6 speeds from 0 to 16,000 rpm. Beats, macerates, pulverizes and emulsifies to form homogeneous suspensions or foaming mixtures in record time. **No. 1179**

PRODUCTS OF U.S.I.

ALCOHOLS:

Ethyl Alcohol (Ethanol)—Specially denatured—all regular and anhydrous formulas.
Completely denatured—All regular formulas for industrial use, anti-freeze.
Pure alcohol—USP 190°—Absolute, N.F., taxfree, taxpaid.
Butanol (Normal Butyl Alcohol)—Latent solvent for nitrocellulose, solvent for ethyl cellulose, many resins, many chemical syntheses.
Amyl Alcohol, Refined—Fine chemicals, pharmaceuticals.
Fusel Oil, Refined—Blend of amyl alcohols refined by chemical treatment, distillation.
Proprietary Denatured Alcohol Solvents
SOLOX®—General-purpose.
FILMEX®—Special, authorized for certain industries.
ANSOL® M—Anhydrous, special blend for lacquers, resins, etc.
ANSOL® PR—Anhydrous, special blend with higher ester content and solvency for lacquers, resins, etc.

OTHER PRODUCTS:

PETROTHENE® Polyethylene Resins.
Inorganic Chemicals: Ammonia, Caustic Soda, Chlorine, Metallic Sodium, Sodium Peroxide, Sulfuric Acid.
Esters, Ethers and Ketones: Normal Butyl Acetate, Dibutyl Phthalate, Diethyl Carbonate, Diethyl Oxalate, Ethyl Acetate, Ethyl Ether, Acetone.
Intermediates and Fine Chemicals: Acetoacetarylides, Ethyl Acetoacetate, Ethyl Benzoylacetate, Ethyl Chloroformate, Ethylene, Ethyl Sodium Oxalacetate, Sodium Ethylate solution, Urethan USP (Ethyl Carbamate). Dimethyl Hydrazine, Methyl Hydrazine, Aluminum Trimethyl.
Animal Feed Products: Calcium Pantothenate, Choline Chloride Products, Curbay B-G® 80, Special Liquid Curbay®, DL-Methionine, Niacin USP, Riboflavin Concentrates, Vitamin B_{12} and Antibiotic Feed Supplements, Vacotone® Products, Vitamin A, D_3 and K_3 Products, Antioxidant Products.
Pharmaceutical Products: DL-Methionine, N-Acetyl-DL-Methionine, Riboflavin USP, Urethan USP, Intermediates.

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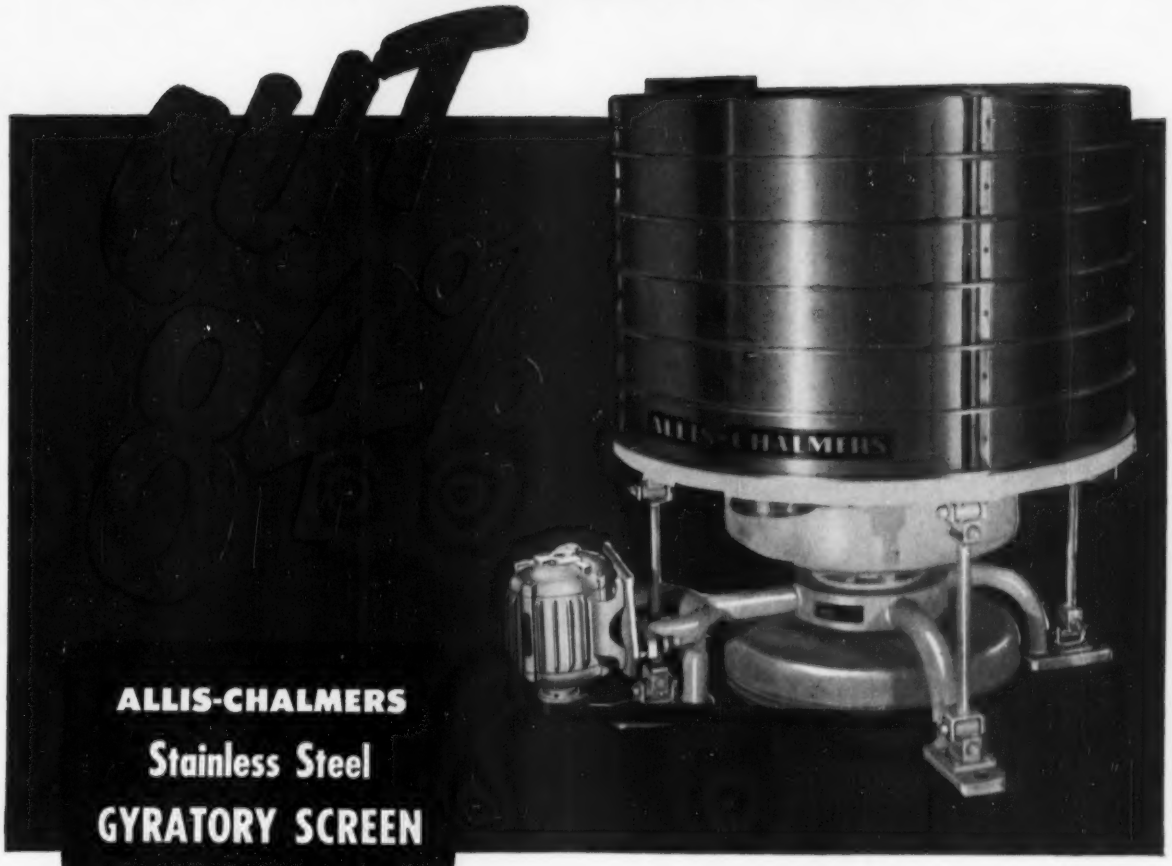
Space Requirements



Eight Allis-Chalmers Units Do Same Job Formerly Done by Sixteen Electro-Magnetic Screens in Large Chemical Plant

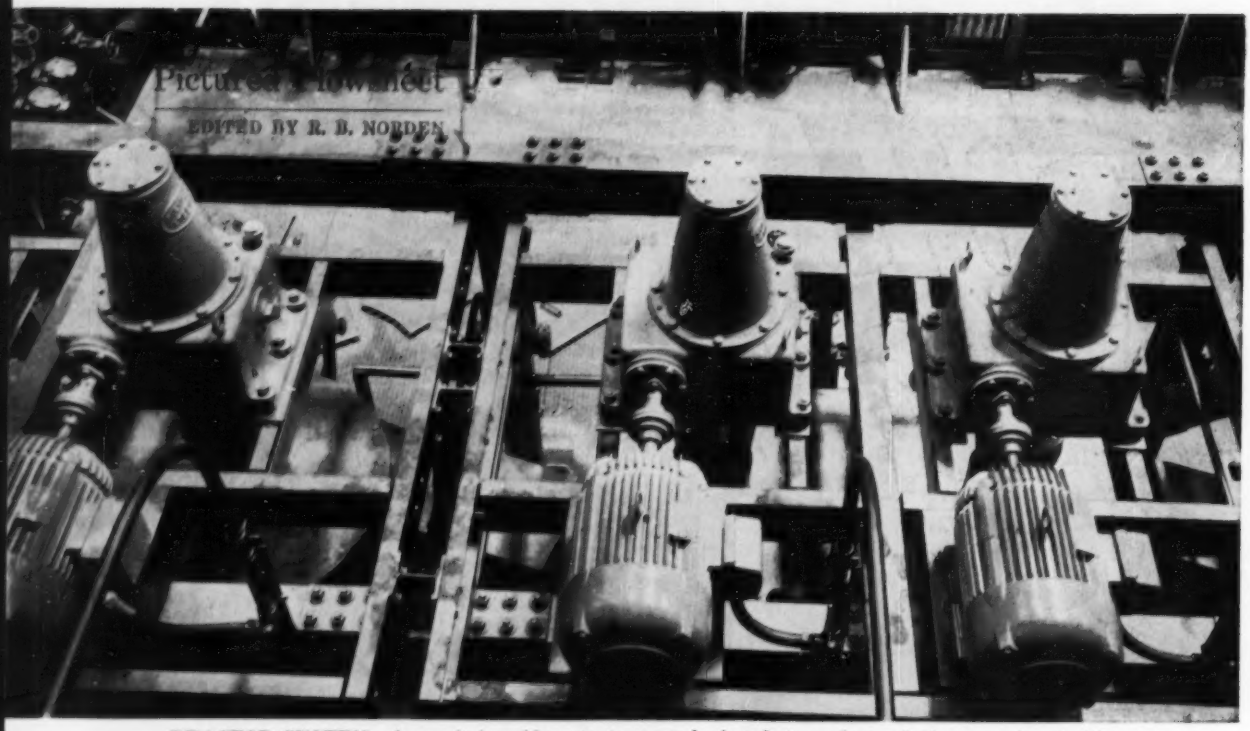
IN THIS installation — as in most plants where screening is done — two factors make this remarkable achievement possible. (1) The stacked-deck design of the Allis-Chalmers stainless steel gyratory screen provides up to 35 square feet of screening area in just 16 feet of floor space. (2) The gentle but thorough gyratory action provides maximum capacity by exposing product to entire screening area.

Noise Level Greatly Reduced — The comparative quietness of the Allis-Chalmers gyratory screens was apparent as soon as they were installed. In these units, a dynamically balanced mechanism assures quiet, vibrationless performance. Operating economy (low power requirement) was another advantage gained in the change to A-C screens.

Improved Quality Control — In addition to top screening efficiency and economy, this newest and finest of mechanical screens is built to give you profit-insuring quality control and quick, sanitary, simplified maintenance. Get the complete story. Contact your nearby Allis-Chalmers representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. Ask for Bulletin 07B8446.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS



REACTOR SYSTEM where nitric acid contacts ground phosphate rock, producing complex fertilizer.

Process Trend: Nitric Acidulation Frees P_2O_5

Nitric acidulation processes are gaining ground. They produce cheap, concentrated fertilizers. A good example: Calspray's plant, on stream this month.

Touted as a "progressive advance in the production of synthetic plant foods," California Spray-Chemical's new multimillion dollar, complex* fertilizer plant goes on stream this month at Richmond, Calif.

Nitric acid—now second in importance to sulfuric as an industrial acid—is the main acidulating agent for phosphate rock at Calspray. This is a basic departure from long established U. S. practice calling for sulfuric acid to free P_2O_5 tied up in the rock.

* Also known as nitrophosphate or compound fertilizers. They usually contain balanced concentrated quantities of the three primary fertilizer ingredients—N, P_2O_5 and K_2O. Calspray can produce such compounds as 20-20-0 and 12-12-12. These are percentages of N, P_2O_5 and K_2O based on a ton of product. Nominal complex fertilizer capacity (12-12-12) at Calspray (wholly owned subsidiary of Standard Oil of Calif.): 400 ton/day.

▶ **Why Nitric?**—To understand why Calspray turned to a nitric acidulating process, developed by Societe Potasse et Engrais Chemiques (PEC), you have to look at the process chemistry and Calspray's integrated operations.

While successful in Europe for many years, little work was done on nitric acidulation in this country until the sulfur shortage of 1950-51. This shortage no longer exists. But it did produce a number of new techniques and focused attention on European practices.

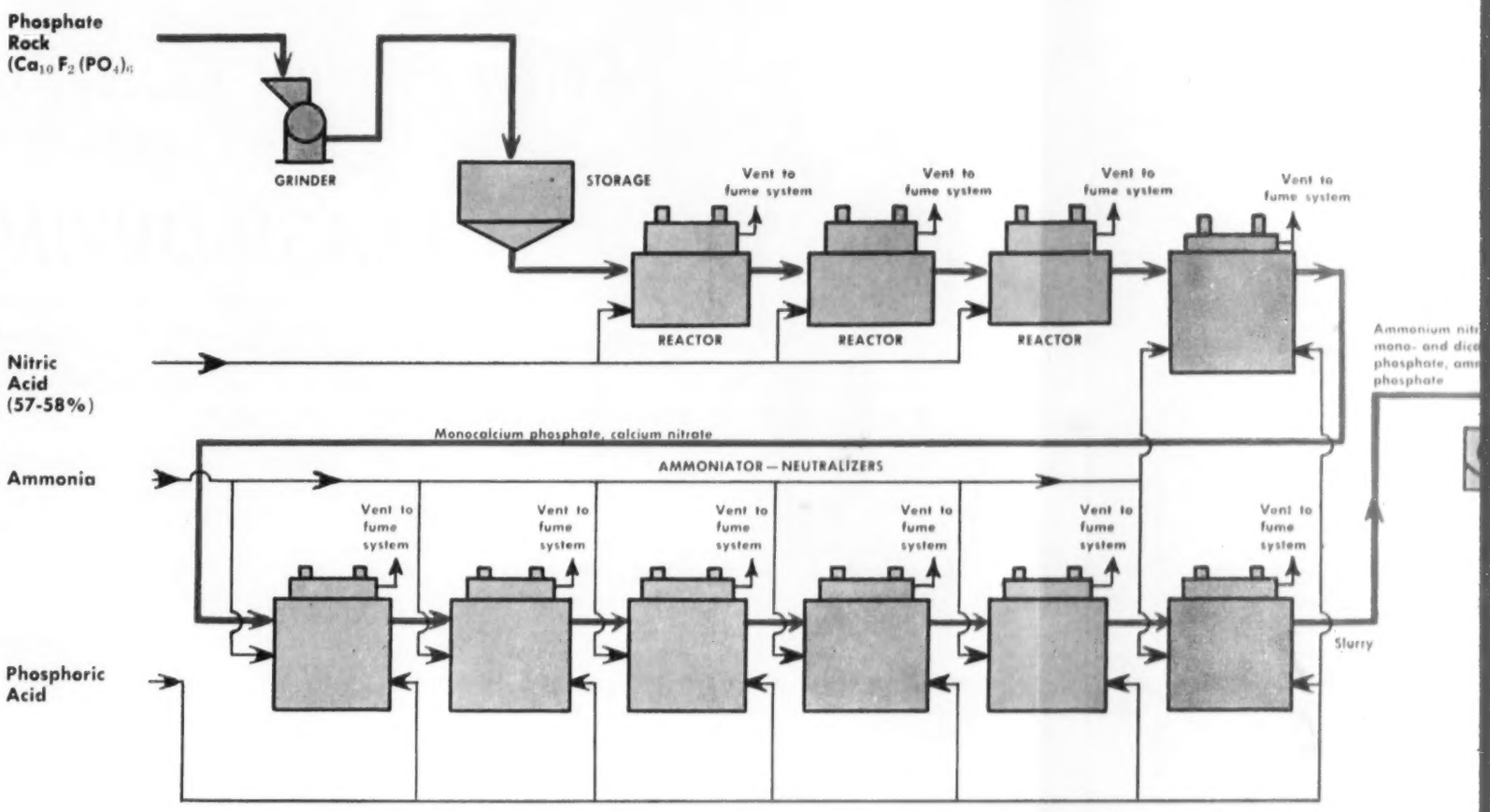
Process economics show up sharply when you compare the action of the two different acids on phosphate.

In ordinary superphosphate production hydrogen from sulfuric reacts with phosphate rock ($Ca_{10}F_2(PO_4)_6$) forming phosphoric acid and calcium sulfate. Phosphoric acid then reacts with more rock forming mono and dicalcium phosphate. Calcium sulfate is worthless as a fertilizer material.

However, nitric acidulation produces calcium nitrate, a nitrogen carrier. This nitrogen is converted into plant food.

This doesn't mean that concentrated phosphate fertilizer producers can immediately switch over to nitric acidulation. The shipping costs for nitric would make this uneconomical in many cases. But the nitric acidulation process definitely has the economic edge in an integrated nitrogen-chemical plant, where there is an ammonia unit and captive nitric acid via ammonia oxidation. This is exactly the situation at Calspray.

▶ **Process Difficulties**—Going commercial with nitric acidulation hasn't been without some difficulties. The TVA has been



working on perfecting nitrophosphate processes for a number of years. Other companies have tried variations. Allied Chemical has a plant at South Point, Ohio, based on nitric-sulfuric, while Associated Cooperatives at Sheffield, Ala., operates a plant rumored to be based on nitric-phosphoric. Probably Calspray has the first commercial plant in the U. S. operating on straight nitric.

But look at some of the problems PEC had to solve in developing the process:

• Calcium nitrate is a hygroscopic, corrosive material, not recommended as a fertilizer. Part is converted with ammonia to ammonium nitrate. The remainder reacts with phosphoric, sulfuric or CO_2 forming calcium phosphate, sulfate or carbonate.

• A material with explosive properties—ammonium nitrite—can form from ammonia and nitrogen fumes. This has been overcome by integrating an efficient fume elimination unit with the reactor system.

• Ordinarily you can't put too much ammonia into a solution of monocalcium phosphate. It will "revert" into the insoluble form—tricalcium phosphate—which is worthless as a fertilizer. The PEC process calls for addition of small quantities of a metallic salt ($MgSO_4$) combined with a slow rate of neutralization and vigorous agitation to prevent reversion. This technique permits ammonia to be added up to a pH of around 10.

All of these improvements are at the Calspray plant—engineered by the U. S. licensee, Chemical & Industrial Corp. (see flowsheet).

▶ **Process Feature**—Heart of the process is the reaction system. Here ground phosphate rock reacts with 57-58% nitric acid in a series of stainless-steel vessels, fitted with high-speed agitators. Acidulation produces a slurry of calcium nitrate, phosphoric acid, monocalcium phosphate in solution, and insoluble impurities.

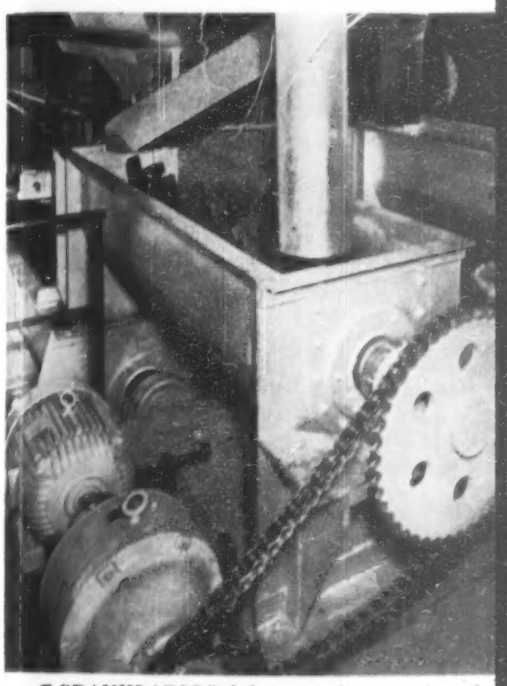
Phosphoric or sulfuric comes in through open-end pipes to each of a series of stainless ammoniator-neutralizers.

Anhydrous ammonia is also added here. It reacts with part of the calcium nitrate, forming ammonium nitrate. Also it reacts with free phosphoric, producing mono-ammonium phosphate. Calcium from the calcium nitrate recombines with phosphoric acid to produce dicalcium phosphate.

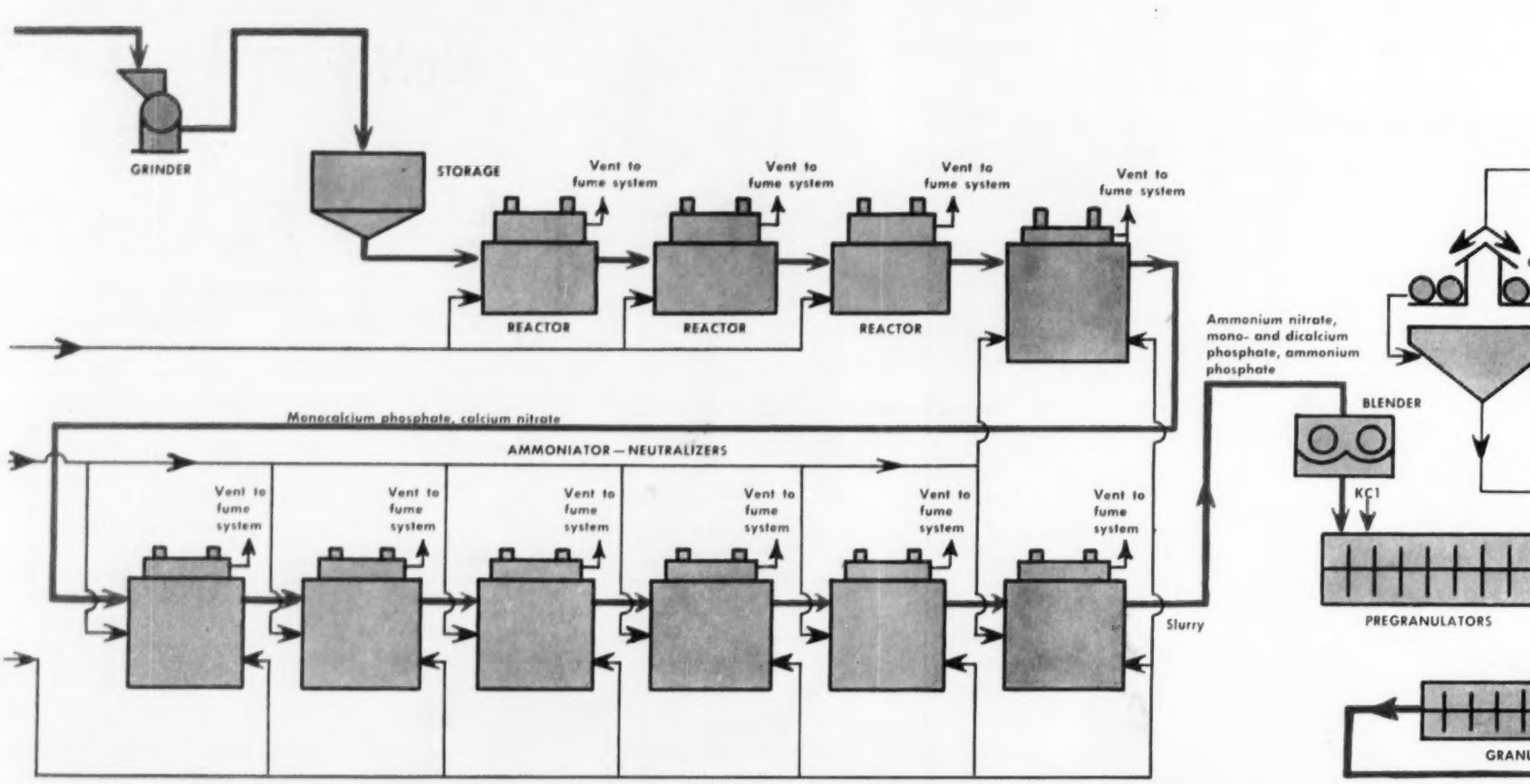
Slurry from the reaction system goes to a continuous ribbon blender, then to a paddle mixer (pregranulator) where potash (KCl or K_2SO_4) comes in.

In the granulator product-fines are added. As the paste thickens spherical pellets, rolled by the action of the granulator agitators, form 2-4 mm. in dia.

These feed into a direct-fired rotary dryer. Dried material is screened and fines recycled to the granulator. Oversize is crushed then recycled to the granulator. Cooled final product—a sharp screen cut—goes through a coating drum.



GRANULATORS bring together reaction slu recycle fines. A thick paste, then spherical pellet



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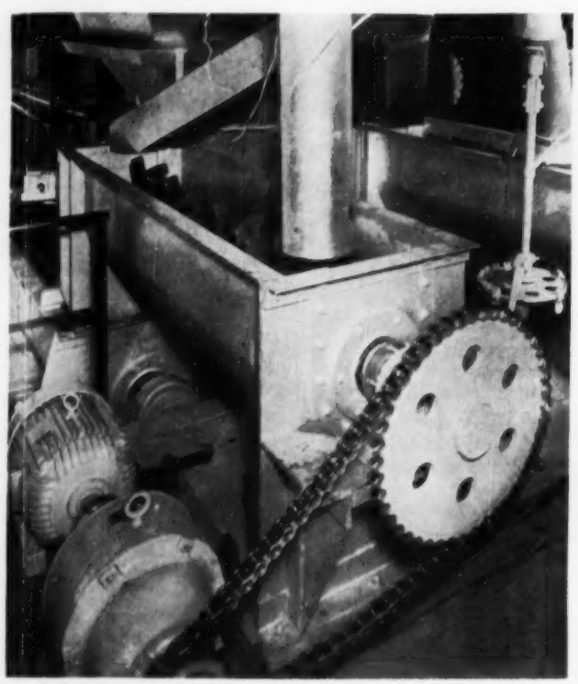
Anhydrous ammonia is also added here. It reacts with part of the calcium nitrate, forming ammonium nitrate. Also it reacts with free phosphoric, producing mono-ammonium phosphate. Calcium from the calcium nitrate recombines with phosphoric acid to produce dicalcium phosphate.

Slurry from the reaction system goes to a continuous ribbon blender, then to a paddle mixer (pregranulator) where potash (KCl or K_2SO_4) comes in.

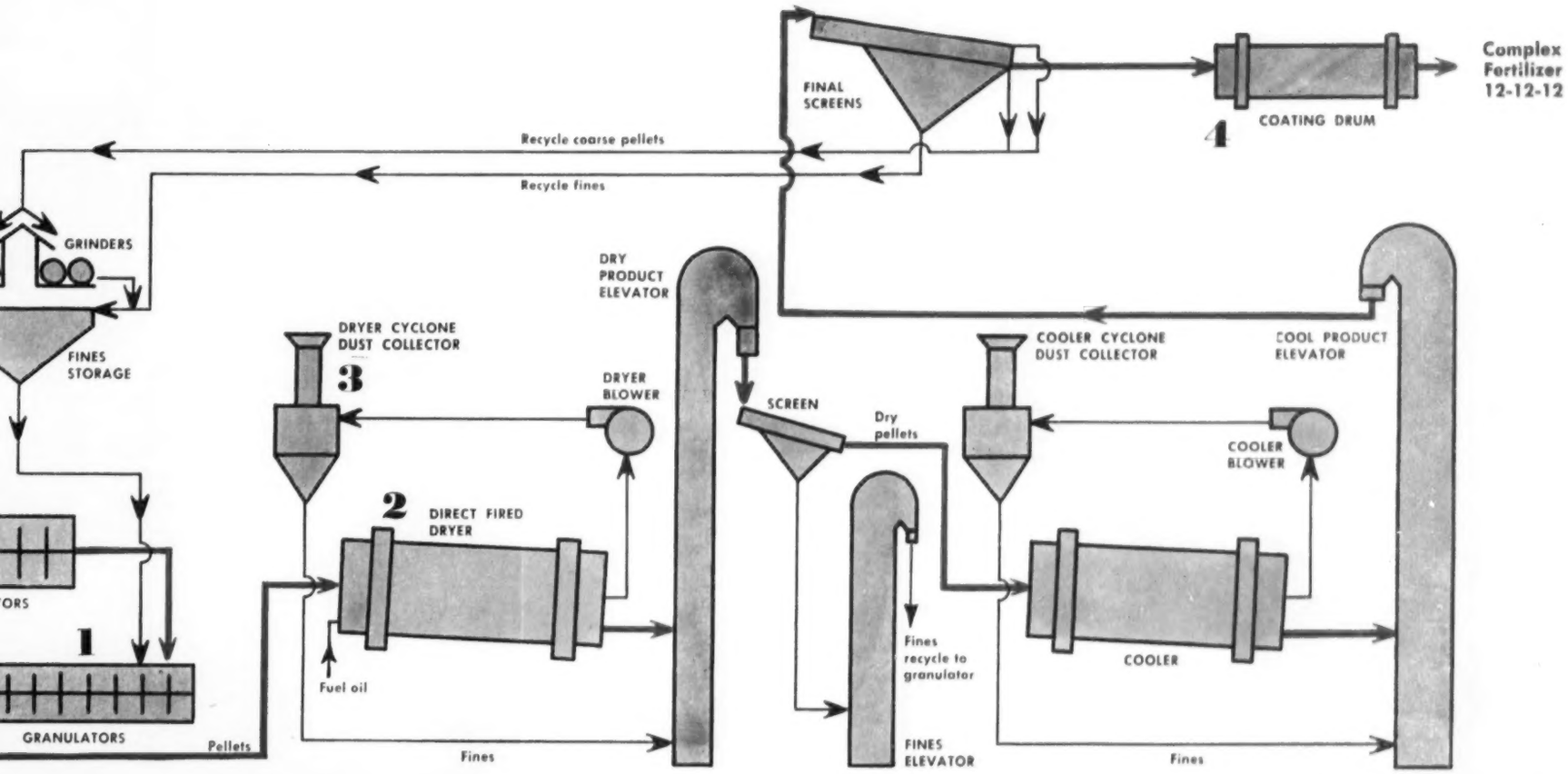
In the granulator product-fines are added. As the paste thickens spherical pellets, rolled by the action of the granulator agitators, form 2-4 mm. in dia.

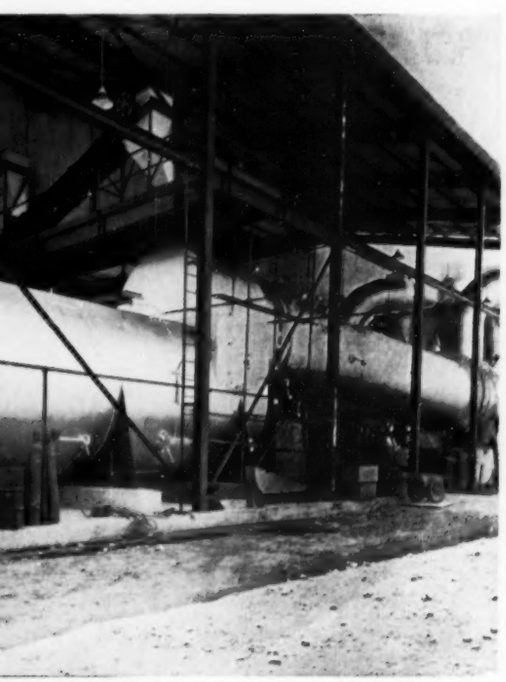
These feed into a direct-fired rotary dryer. Dried material is screened and fines recycled to the granulator. Oversize is crushed then recycled to the granulator. Cooled final product—a sharp screen cut—goes through a coating drum.



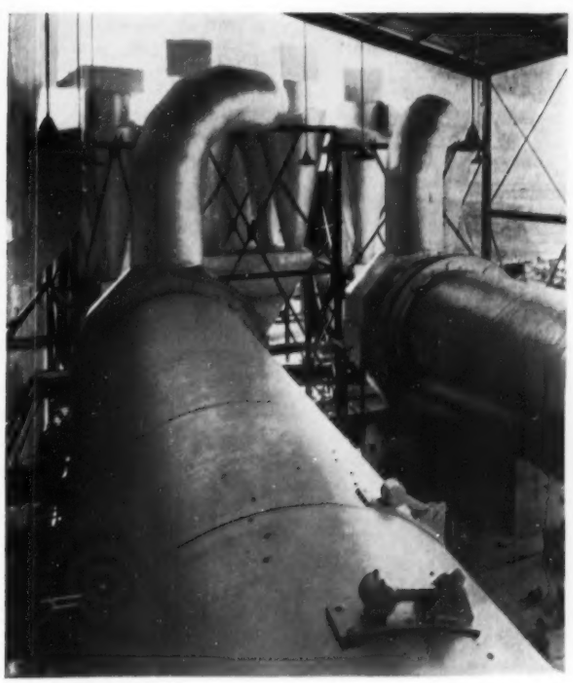
1 GRANULATORS bring together reaction slurry and recycle fines. A thick paste, then spherical pellets, form.

2 ROTARY
of comple

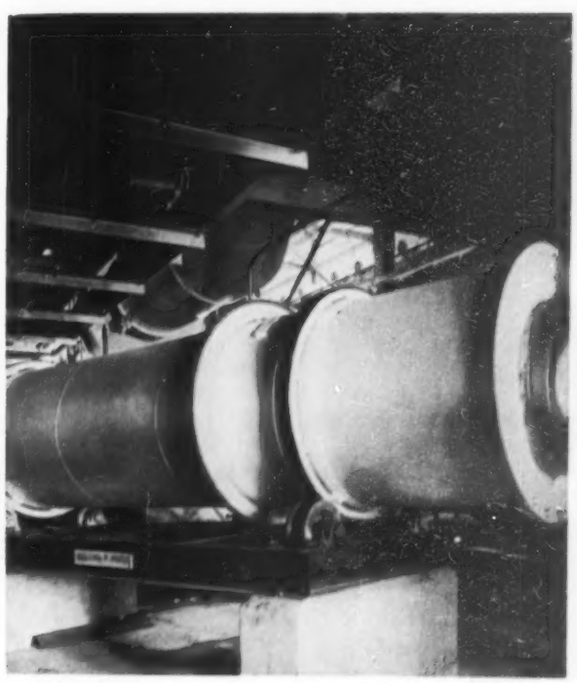




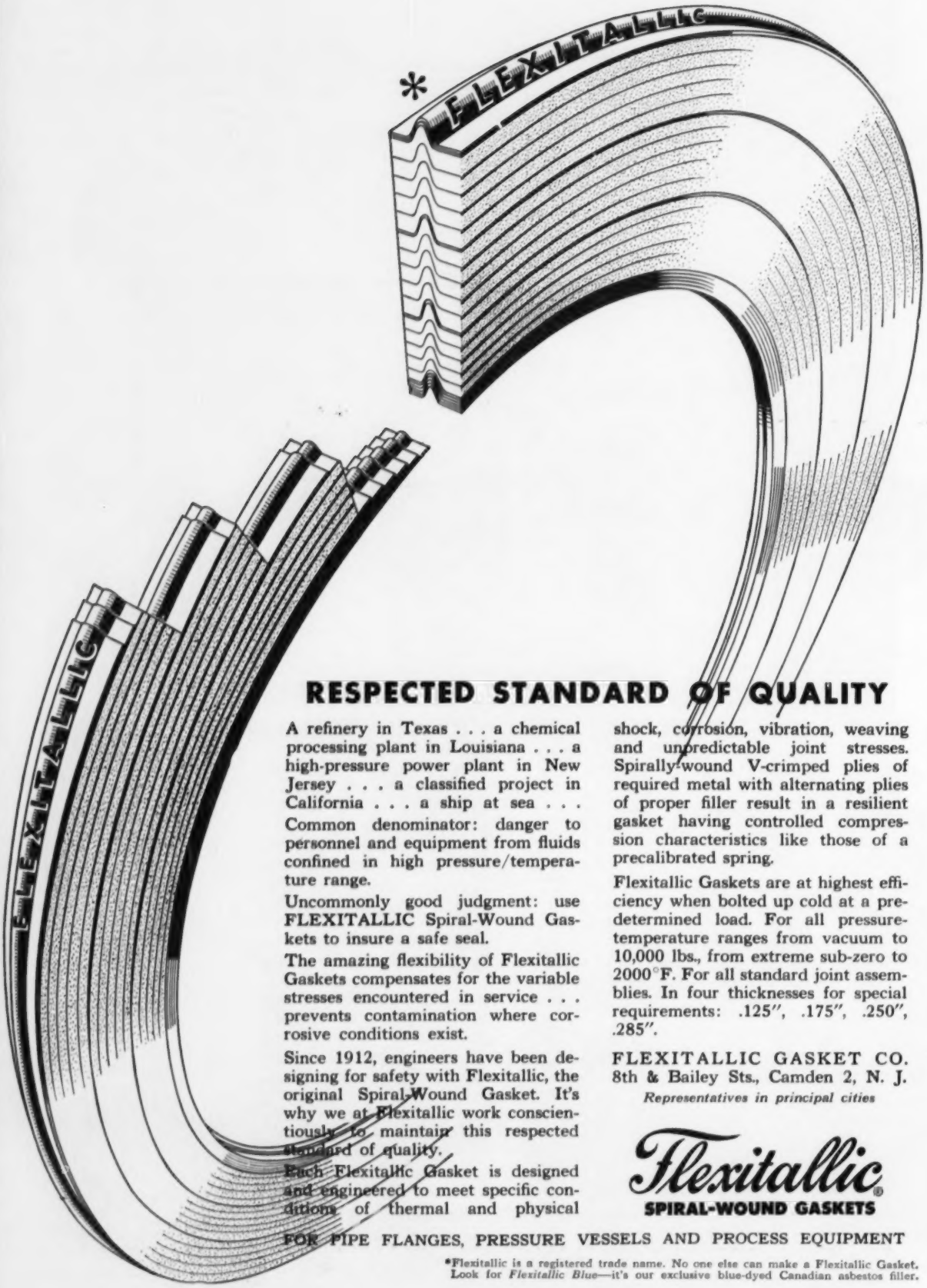
OTARY DRYERS remove moisture from the pellets f complex fertilizer coming off the granulator.



3 **CYCLONES** are part of the fines recovery system on the rotary dryers. Fines go back to the granulator.



4 **COATING** insures that pellets will be free-flowing—particularly if they contain high percentages of NH_4NO_3.



RESPECTED STANDARD OF QUALITY

A refinery in Texas . . . a chemical processing plant in Louisiana . . . a high-pressure power plant in New Jersey . . . a classified project in California . . . a ship at sea . . .

Common denominator: danger to personnel and equipment from fluids confined in high pressure/temperature range.

Uncommonly good judgment: use FLEXITALLIC Spiral-Wound Gaskets to insure a safe seal.

The amazing flexibility of Flexitallic Gaskets compensates for the variable stresses encountered in service . . . prevents contamination where corrosive conditions exist.

Since 1912, engineers have been designing for safety with Flexitallic, the original Spiral-Wound Gasket. It's why we at Flexitallic work conscientiously to maintain this respected standard of quality.

Each Flexitallic Gasket is designed and engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally-wound V-crimped plies of required metal with alternating plies of proper filler result in a resilient gasket having controlled compression characteristics like those of a precalibrated spring.

Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure-temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285".

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SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue*—it's our exclusive blue-dyed Canadian asbestos filler.

With 10 years on corrosive waste gases this Crane Valve is still maintenance-free

THE CASE HISTORY—For over 10 years, a large integrated refinery has handled corrosive waste gases on its refinery flare line with this 10-inch No. 47X Crane cast steel 150-pound valve. Used as the main gate valve, it is operated about once a month.

Despite the long periods of inoperation, this Crane valve still has a perfect record for performance, maintenance and service costs—not one nickel has been spent to keep it on the job. It has never leaked, and it operates as easily as it did 10 years ago.

Actually, Crane case histories like this are quite common in oil refineries. You'll find Crane valves on practically every type service with similar performance records.

From the outside, Crane valves may look like many other makes, but inside, it's a different story. Here you'll find the famed Crane quality in design and construction—in the precision fit and superior alloys that assure maintenance-saving, trouble-free operation.

You can order Crane cast steel valves in gates, globes, angles and checks—sizes up to 24 inches—in pressure classes to 2500 pounds.

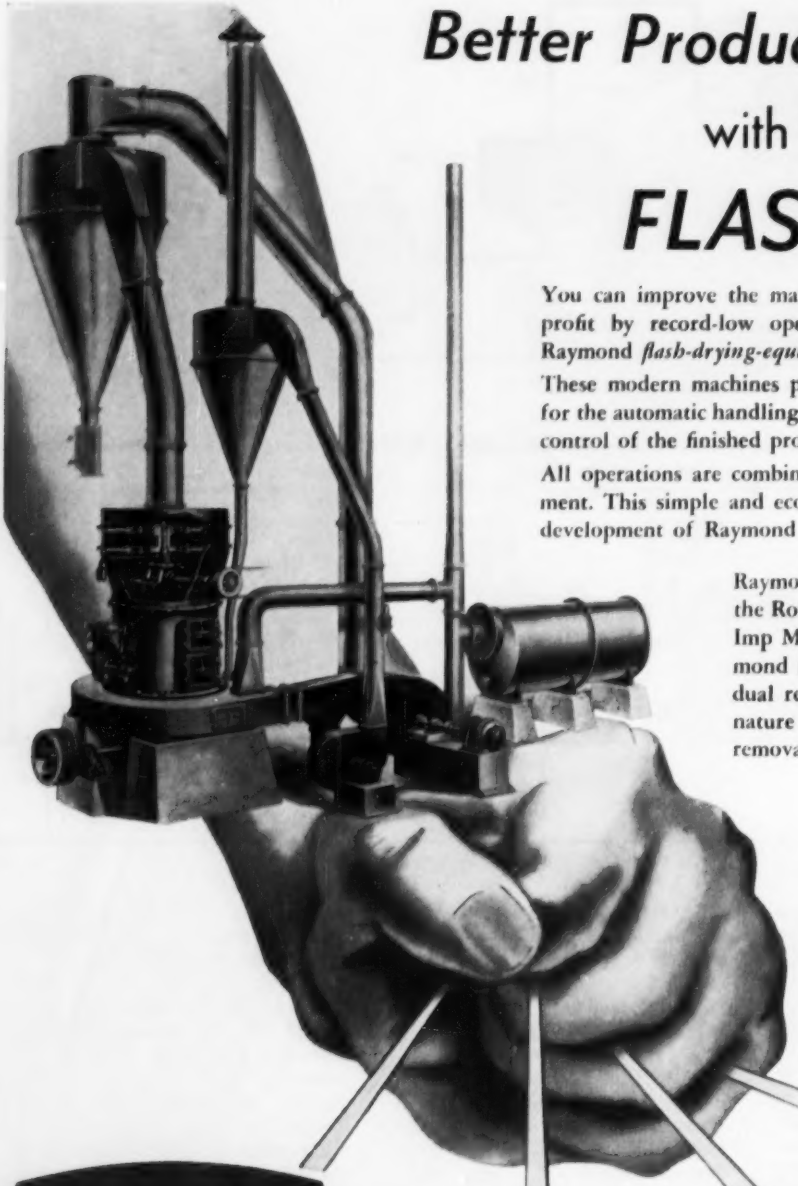
Call your local Crane Representative for valuable help in specifying and ordering, or write to address below.

CRANE VALVES & FITTINGS

PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

Better Product CONTROL with RAYMOND FLASH DRYING



You can improve the marketability of your product and profit by record-low operating costs when you install Raymond *flash-drying-equipped* pulverizing mills.

These modern machines provide a clean, dust-free system for the automatic handling of the material and for complete control of the finished product.

All operations are combined in one single unit of equipment. This simple and economical method is an exclusive development of Raymond engineers.

Raymond Flash Drying is available with the Roller Mill, as shown, also with the Imp Mill or the Cage Mill. Every Raymond installation is *tailored* to individual requirements as to plant capacity, nature and fineness of product, moisture removal.

For further details and types of materials handled, write for Catalog No. 82.

FINENESS

Whizzer air separation gives instant fineness control over wide range of classification by one simple adjustment.

UNIFORMITY

Close selection of fines and continuous return of the oversize to grinding chamber for further reduction, maintain consistent uniformity.

TEMPERATURE

Short retention time and relatively small amount of material in system, insure fast and close temperature control.

DRYNESS

Desired percentage of moisture is removed by Flash Drying simultaneously with the grinding operation.

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Raymond Division

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Combustion Engineering-Superheater Ltd., Montreal, Canada

Men of the Month:

Robert S. Ray, Jack Tielrooy

Brea Chemicals augments effective management team by appointing two chemical engineers to top posts.

When Union Oil's bright, young subsidiary—Brea Chemicals, Inc.—simultaneously advanced a couple of bright, young (37) men to vice presidencies and membership on the board of directors and executive committee, it was a special cause for celebration in a pair of congenial California households.

Reason: The two—Jack Tielrooy, vice president, commerical development, and Robert S. Ray, vice president, manufacturing—have been best friends since boyhood. They were college classmates (Cal Tech, 1940), both won their spurs with Shell Chemical before joining the Union family. Now they're neighbors in Fullerton, Calif., which, like nearby Brea, is on the sprawling outskirts of Los Angeles.

Homer Reed, Brea president, thinks they've got the zest, ideas, and skill it takes for a fledgling company to make headway in a competitive growth field.

▶**Quite a Change**—While at Shell, both men had been chemical engineers concerned with process design. Their design work (which they did separately—they never worked together before Brea) was important and varied, and that experience, of course, is a considerable part of their value to Brea. But neither had had experience exactly comparable to their present functions.

At Brea, Tielrooy is heavily involved with market research and other economic concerns pretty far afield from strictly interpreted chemical engineering. And Ray is concerned less with process design than the people who make it work. They both have managerial responsibilities far beyond anything in their previous careers.

And they're both thriving.

▶**Jack Tielrooy**—President Reed had studied the organization of a lot of chemical companies during Brea's incubation. He knew how much it meant to have a man whose single responsibility is the future, who isn't distracted by day-to-day current operations, and whose ideas don't have to filter up through operating departments—bucking the natural "it-can't-be-done" opinions of people bogged down and biased by problems of the present.

These days, for Brea, that man is Jack Tielrooy. His commercial development post is on a level with the vice presidencies of manufacturing and of marketing and distribution. It's his job to launch Brea into new products, new fields.

Tielrooy has been a "futures" man since his start with Union. That was in 1948. He was part of a process development group—one of three groups working under Reed (then Union's chief engineer)—to develop plans for what became a $75-million, five-year program of facilities expansion and product re-emphasis.

In 1951, he took on a special assignment, heading an eight-man group to study possibilities for Union's entrance into chemicals. Out of several schemes studied by the group, aqua ammonia was selected as the starter for what became Brea Chemicals.

Naturally, when Brea first looked ahead to diversification, he had a major share in a proposed joint venture in the polyethylene field with a major chemical firm.

Here's how he explains it:

"For an established company to bring out a new product in its own field, the usual length of time between conception and fruition is seven to ten years. For a company without a backlog of experience, obviously it's going to take considerably longer. We can't wait that long. We want to grow now."

▶**His Code**—Tielrooy won't talk just now about any specific Brea plans for the future, in plastics or out. He will talk,

corrosion problem on your MIND?

then SPECIFY ATLAS

Throughout the industry, ATLAS means COMPLETE CORROSION PROTECTION. In construction of all types of plant equipment and facilities where corrosives are present, Atlas materials of construction are used to provide long term, low maintenance service.

Atlas can help you with your problems with on-the-spot technical advice, engineering and design assistance, highest quality corrosion proof materials and construction services from beginning to end.

For data on corrosion proofing of any of the items listed below or on any other pieces of plant equipment, contact Atlas . . . first in complete corrosion service. . . .

PLANT CONSTRUCTION

ceilings	manholes	sumps
curbing	piers	trenches
food plant floors	pits	walls
industrial floors	stacks	waste lines

PLANT EQUIPMENT

chemical tanks	fume exhaust systems	storage tanks
continuous picklers	pickling tanks	tank trailers
dip baskets	plastic pipe systems	tumbling barrels
fume exhaust hoods	plating tanks	vessel exteriors

Write for your copy of Bulletin CC-3 giving informative data on the complete Atlas line.

ATLAS MINERAL PRODUCTS COMPANY

TECHNICAL REPRESENTATIVES THROUGHOUT THE UNITED STATES

though, about what he thinks you need in a job like his:

"You've got to be willing to stick your neck out if you want to get anywhere. There aren't any crystal balls to show you a sure thing. You have to have faith in your extrapolations and be willing to move before you have all the facts. You can never get them all in advance anyway, and—in this fast-moving chemical industry—if a company delays till it thinks all risks have been eliminated, chances are the opportunity will have been eliminated too."

This attitude pervades Tielrooy's whole personality. He likes dealing in futures. He has a reputation for rapid decisions. He tends to be impatient, and his positive approach sometimes ruffles feathers. He always has worked fast—and accurately, too. (Says Ray, "Jack was the only guy in our class who could get good grades without burning the midnight oil.")

His reputation for getting a fast bearing on a new problem is impressively widespread. "He's always on the right route," says an associate. "He never seems to go up a blind alley. Maybe as far as he's concerned he does, but you never know about it."

Asked how, as an engineer whose background has been chiefly in design work, he takes to the economic analysis part of his job, he responds with a serious smile: "I find it easy to get interested in anything."

▶ **Bob Ray**—Back in 1953, when Ray first showed interest in joining the Union Oil fold, it was no coincidence that Tielrooy showed up in Homer Reed's office for a casual chat. The two operate a healthy mutual adration society, and it was natural for Jack to put in a plug for his old classmate.

Reed is no man to fill an important post on the basis of friendship alone but, inevitably, his confidence in Tielrooy weighed heavily in Ray's favor. Of course, it didn't take Reed long to see Bob on his own merits; you can't be with Bob Ray five minutes without knowing that you're talking to a man with a very real liking for people and a very real ability for getting along with them.

This probably goes a long way to account for the ease with which he fitted into his present job, with its heavy emphasis on managerial responsibilities.

He still gets to exercise his design talents, of course. His chemical engineers are responsible not only for maintaining the present plant but for making improvements in its processes. And he consults with Tielrooy on the final stages of new plant design.

Mostly, though, he's concerned with the customary headaches of manufacturing operations—personnel, plant functioning, raw material procurement, shipping, warehousing, cost accounting, and the rest. And, since Brea has only one manufacturing facility, it's an especially tall assignment; he fulfills many of the functions of plant manager.

He seems to thrive on headaches.

▶ **His Approach**—Ray claims that his "job, basically, is to get people to work together," and his associates agree that he's got the knack of doing it.

One of his prime convictions is the realization that the best way to make people responsible is to give them responsibilities. And this includes letting them make mistakes.

"But when you give them the freedom to make mistakes, it's a good idea to keep the area of possible mistakes limited—just in case.

"And, to develop people," he says, "you've got to get them in over their heads—but not so far that they get discouraged."

Ray maintains an "open door policy." Any employee is free to walk into his office and talk over any problem. First, though, he should make a conscientious effort to iron them out where they belong — within channels. He feels pretty strongly about the importance of responsibility at all management levels — from foreman up.

Summing up his reactions to his job, Ray has this to say: "I wonder if there's anything else that gives you the feeling of accomplishment you get when you bring people together in an operation like this—where you get a new plant operating at a level of really smooth function-

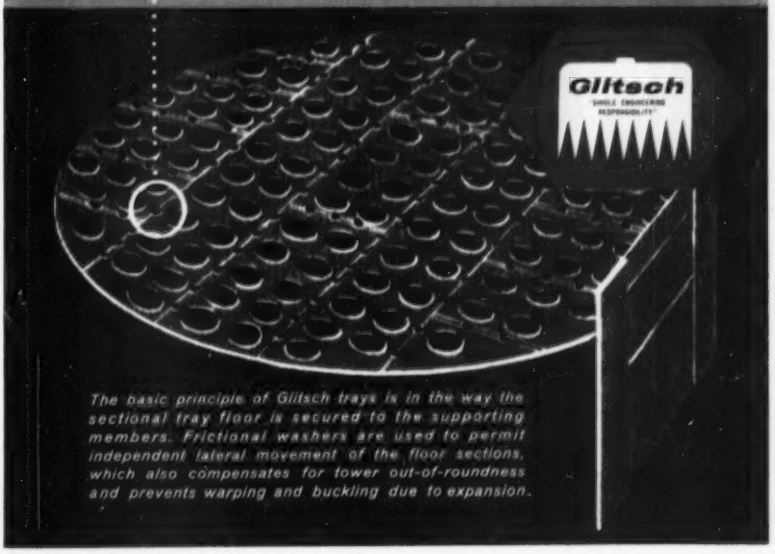
"Truss-Type"® Bubble Trays

TIME-SAVING — COST-SAVING

On Installation and Take-Down

Lightweight Glitsch "Truss-Type"® Trays are comparable in first-costs to heavy plate trays, but when continued economy is considered these facts are significant: Glitsch trays allow use of lightweight alloys, yet provide maximum strength and rigidity for tray sections. Each tray can be installed and removed in sections through the tower manways. "Truss-Type"® Trays are simple in design and can be adapted to any process requirement, any flow type, vessel size, and layout, without sacrificing any features of installation or removability. In addition, when critical corrosion-resistant alloys are required throughout a new unit, Glitsch trays allow a wider distribution of the available materials.

Regardless of your requirements, "Truss-Type"® Trays will save you time and money in the long run. For full details, call your Glitsch representative and ask for a copy of our Catalog No. 150, or write to us at P. O. Box 6227, Dallas. There is no obligation, of course.



The basic principle of Glitsch trays is in the way the sectional tray floor is secured to the supporting members. Frictional washers are used to permit independent lateral movement of the floor sections, which also compensates for tower out-of-roundness and prevents warping and buckling due to expansion.

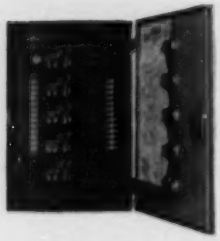
FIRE! HOW TO DETECT AND EXTINGUISH IT IN SECONDS!

HAND PORTABLES

Carbon Dioxide | Foam Soda-Acid Clear Water Anti-Freeze | Pressurized Water Anti-Freeze | Dry Chemical

Kidde CO_2 portables, either trigger-release type or squeeze-valve type models, are available in sizes from 2½ to 20-pound capacities. New Kidde Wet Chemical Extinguishers are available in 2½ gallon bronze or stainless steel models, including pressurized Water or Water-Anti-Freeze units (illustrated). Kidde Dry Chemical extinguishers are available in cartridge-operated models of 20 and 30 pounds capacity or pressurized models of 5 and 10 pounds capacity.

ATMO DETECTING SYSTEMS

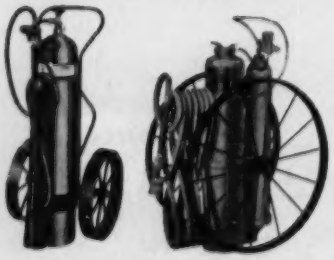


Kidde-Atmo is a wide-area automatic fire detecting and warning system which works on the principle of rate-of-temperature-rise. It is ideally suited for cases where life protection is of vital importance, or where quick, early detection of fire in valuable materials is essential.

The very first hot breath of fire triggers the system, and sounds the alarm. In addition, the system can also close doors, shut off fans or blowers – all *automatically*.

What's more, the Kidde-Atmo system operates independently of regular power sources, will still give protection even if outside power fails.

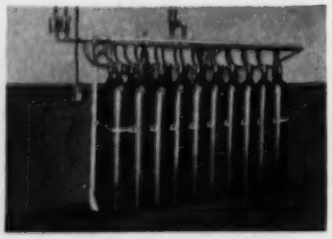
MOBILE EQUIPMENT



CO_2 | Dry Chemical

For major fire hazards, get a mobile unit. Wheeled CO_2 units are available in 50, 75 and 100-pound capacities, in one clyinder. 150-pound Dry-Chemical unit has straight stream for long range ... fan pattern for wide coverage. Both units give expert results even with inexperienced operator.

CO_2 SYSTEMS



New Kidde pressure-operated CO_2 extinguishing systems are individually designed to fully protect even the most dangerous hazards. Directional Valves afford protection to more than one hazard using the same bank of CO_2 cylinders.

Kidde

Walter Kidde & Company, Inc.
1028 Main Street, Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd., Montreal — Toronto

ing. It seems pretty great to me."

▶ **Home Front**—Both men really know how to relax during off hours.

Jack is an avid hobbyist and gadgeteer. His car is radio equipped, and he has a roomful of "ham" equipment at home. As an occasional pastime, it meshes beautifully with his second major hobby—trout fishing. He takes portable ham equipment along on his trips and, in case the family doesn't accompany him, Mrs. Tielrooy is one fishing widow who needn't worry about where hubby is and when he'll return. He keeps in touch via a ham friend near home.

Tielrooy also managed to find time to design his own home—though accidentally. "It just happened," he says, "I started jotting down ideas for someone else to work on, and by the time they were all jotted, the thing was just about designed."

Ray isn't so serious a hobbyist as Tielrooy.

"Basically," he says, "what I enjoy most is being around my family and my home." Like Jack, he also designed his own home. What's more, he built much of it, operating as his own general contractor.

He's an ardent poker player, and shares with Tielrooy an enthusiasm for bridge. "Jack and I worked our way through college at the bridge table," he confesses with a grin.

These days, neither man has time to do as much as he'd like to do outside the office, but a shortage of time is one of the penalties of being key men on the management team of a growth company.

And neither of them seems to mind very much.

Charles H. Schuh has been named technical advisor to the Union of Burma under a contract with Armour Research Foundation of Illinois Institute of Technology, Chicago.

Richard C. Mathews has joined Davison Chemical's catalyst department as a field service engineer. A graduate of South Dakota School of Mines,

Mathews comes to Davison from Standard Oil Co. (Indiana).

Thomas Skeuse has been appointed director of operations of Dixon Chemical & Research, Inc., Newark, N. J., producers of sulfuric and other acids. He comes to Dixon from Allied Chemical & Dye's General Chemical division.

George M. Halsey

Election of George M. Halsey as vice president of the Glidden Co., in charge of the chemicals-pigments-metals division, has been announced. Since 1950, Halsey has been director of the division's manufacturing operations.

In his most recent capacity, Halsey took charge of the engineering and construction of Glidden's new $8 million Adrian D. Joyce works at Baltimore (a facility for the production of titanium dioxide). Soon he'll direct the $20 million proposed expansion of the plant.

Halsey began his career with the firm in 1933 as a draftsman in the St. Helena plant in Baltimore. By 1946, he had become the plant's manager. Halsey is a graduate of Baltimore Polytechnic Institute and of Johns Hopkins University.

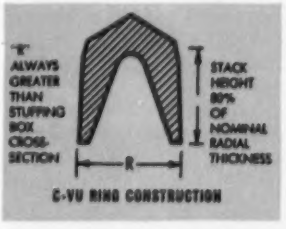
Ivan E. Welborn has been named superintendent of the new formaldehyde and synthetic resin plant being built by Borden's chemical division at Fayetteville, N. C.

Henry A. Saller, one of the country's leading authorities on materials used in the construction of atomic reactors, has been named an assistant

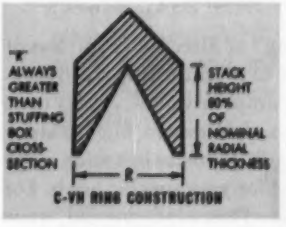
Countless successful applications of C-V Rings under the most severe service conditions have made this the closest approach to a universal packing.

It will effectively handle all industrial acids, alkalis, solvents, organic and hydraulic fluids . . . temperatures from −120°F. to +500°F. . . . is equally suited to valves, pumps, mixers, hydraulic cylinders and like equipment.

"John Crane" C-V Rings have extremely low coefficient of friction. "Breakout" friction is only slightly higher than running friction.



C-VU RING CONSTRUCTION



C-VH RING CONSTRUCTION

TWO STYLES ARE AVAILABLE:

C-VU RINGS *for low pressure service* —such as control and regulator valves handling gases and fluids, where it is necessary to have a very sensitive and resilient type packing.

C-VH RINGS *for high pressure service* —for use in pumps, hydraulic cylinders and like services at pressures ranging to 500 psi. and over. These rings are constructed with a heavy wall heel to withstand pressure requirements. They are designed to provide voids between rings, so that as the Teflon expands due to heat, this take-up room minimizes any excess friction in the stuffing box.

"John Crane" C-V Rings are available in full line of standard sizes and male and female adaptors. Sizes can be molded to stuffing box specifications.

Request Bulletin T-110.

*"John Crane" C-V Rings are made from Chemlon—*the best in DuPont Teflon.*

Crane Packing Co., 6451 Oakton St., Morton Grove, Ill. (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., Hamilton, Ont.*

CRANE PACKING COMPANY

Now SOLKA®-FLOC is TWICE TWICE as effective for caustic purification

Requirements of the caustic industry today are demanding greater purification of caustic than in the past. To match the demand, SOLKA-FLOC*—chemically pure wood cellulose—has been developed to the point where it is consistently twice as effective for caustic purification.

. . . and the only adsorbent that also functions as a superior filter aid

The advantages of SOLKA-FLOC as a fast, safe filter aid for makers of caustic soda, industrial metals, pharmaceuticals, and many other things, include . . . economical volume of clarified filtrate . . . adsorption of impurities . . . stable pre-coat . . . no "bleeding" of filter aid . . . no loss of cake due to pressure drop . . . no abrasion of pumps or valves . . . very little retention of filtrate in filter cakes.

SOLKA-FLOC comes in a wide range of grades for your specific needs. For samples and more information, write Dept. DF-10, our Boston office. A representative will gladly call.

*Sold in Canada by Brown Forest Products, Ltd., Montreal, Que. (Alpha-Floc)

BROWN COMPANY

General Sales Office:
150 Causeway Street, Boston 14, Mass.

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Berlin and Gorham, N. H.; Corvallis, Ore.

NAMES . . .

technical director at Battelle Institute, Columbus, Ohio.

Elmer K. Stilbert has been promoted to staff manager of coating materials for Dow Chemical's plastics department. He'll be responsible for long-range planning for coating materials.

Emo D. Porro

Thermo Materials, Inc., a new California firm specializing in the development and production of precision high temperature industrial ceramics, has named Emo D. Porro as its executive vice president and general manager.

Porro, an original member of Stanford Research Institute, had served as engineering assistant to the director of the Institute until his resignation recently.

The new firm is under the joint ownership of Gladding, McBean & Co., Provident Securities Co., and Frenchtown Porcelain Co.

U. T. Greene, Cleveland, an executive of Diamond Alkali Co., has been appointed director of the chemical and rubber division, Business & Defense Services Administration, U. S. Dept. of Commerce.

Robert H. Dhonau and **Arthur R. McDermott** have been added to the staff of the development and service department of Emery Industries, Inc.

Donald A. M. Mackay has been appointed associate director of research of Evans Research & Development Corp. Mackay is a specialist in ap-

plying spectrophotometric and chromatographic techniques to problem solving in chemical research.

Leonard Scribner has returned to Fansteel Metallurgical Corp. as assistant manager of the metals and chemicals division. For a short time, he had been associated with Crane Co.

Deane O. Hubbard has been named a specialist in chlorine plant design for the H. K. Ferguson Co., Cleveland.

Robert W. Laundrie has been appointed chief process chemist in charge of process engineering for General Tire & Rubber Co. Louis E. Gressingh has been named process engineer.

Norman Ernstein has joined the staff of B. F. Goodrich Co.'s research center, Brecksville, Ohio, as a chemical engineer in the high pressure laboratory.

Yoonsik Lee of Taegue, Korea, has joined the research department of Commercial Solvents Corp., at the firm's Terre Haute, Ind., research center. He received his chemical engineering degree from Tri-State College, Angola, Ind.

Ronald C. Vickery, London-born scientist, has been appointed head of the chemistry department of Horizons, Inc., Cleveland industrial research organization.

Virgil Brown and **Paul L. Nevil** have been promoted to senior coordination technicians at Humble Oil & Refining Co.'s Baytown, Tex., refinery.

Alan A. Weinberg has joined Hooker Electrochemical's plastics laboratory staff, research and development department as research chemist. He'll work in the polyester group.

Arthur G. Dreis has been appointed assistant manager of the chemistry and chemical

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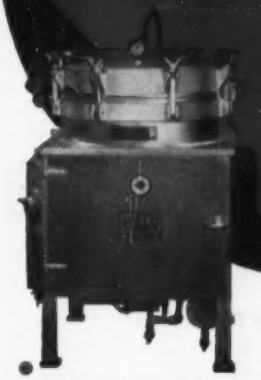

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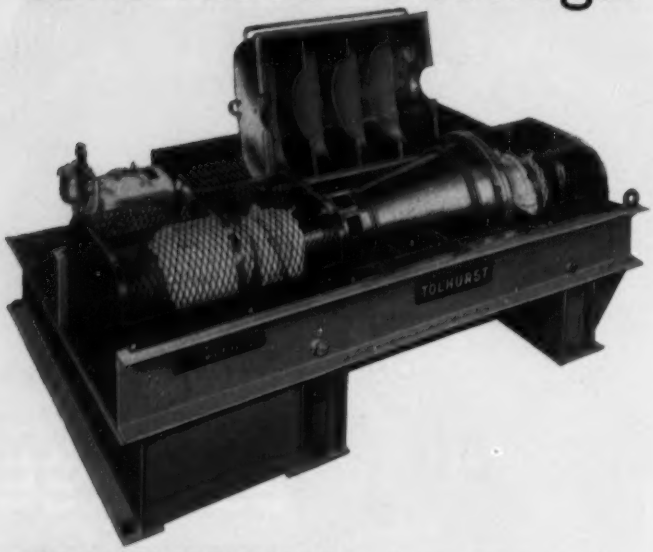

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engineering research department at Armour Research Foundation of Illinois Institute of Technology, Chicago.

William E. Hanford, a graduate of the Philadelphia College of Pharmacy and Science and director of research for the M. W. Kellogg Co., was presented with an honorary degree of Doctor of Science at his alma mater's 135th commencement exercises.

Stuart Nussbaum has been selected as a member of the staff of the Tonawanda, N. Y., laboratories of Linde Air Products Co.

Kyle W. Charlton has been promoted to operating supervisor in Mobay Chemical's polyester department, in New Martinsville, W. Va.

Robert Grandpre, of Springfield, Mass., has been appointed to the technical service department of Shawinigan Resins Corp.

Vernon D. Wallingford has been appointed to the new post of senior scientist in Mallinckrodt Chemical's technical division. **Albert Q. Butler** has been named manager of the division.

Paul N. Cheremisinoff has been appointed manager of the Paterson, N. J., plant of the Alsynite Co. of America. Previously, he had served in a similar capacity with Joseph Turner & Co.

S. E. Gewin has been appointed district manager of the Chicago office of Bristol Co., Waterbury, Conn. **Walter Messner** will succeed Gewin in his former post as manager of the St. Louis office.

U. S. Senator John F. Kennedy received one of six honorary doctor of science degrees conferred by Lowell Technological Institute on September 27, at a special convocation in observance of the Perkin Centennial.

Richard D. Dunlop has been named executive assistant for

manufacturing for Monsanto Chemical in St. Louis, Mo. Formerly, Dunlop had been assistant general manager of the firm's plastics division—a post he had held since 1954.

Delbert J. Massey has been appointed a project specialist in the development department of Monsanto Chemical Co.'s organic chemical division in St. Louis.

George Basil Blonsky has been appointed project engineer by F. H. McGraw & Co. for a $25 million fertilizer plant which the firm is building in Korea. He'll operate from headquarters in New York City.

Edward M. Laczynski has joined Michigan Chemical Corp.'s research staff. Most recently, he had been associated with Union Carbide Nuclear Co., Bishop, Calif.

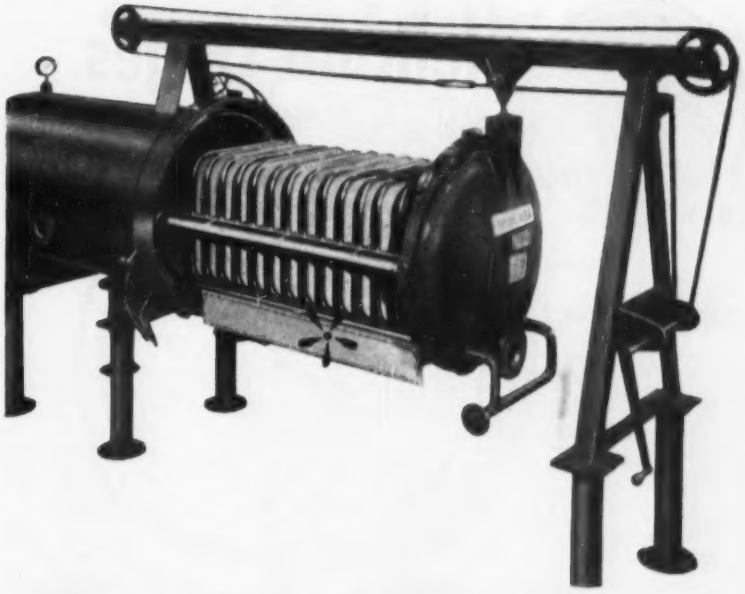
James Dillon, a vice president of National Starch Products since 1954, has been elected a member of the board of directors. Dillon is in charge of the firm's synthetic resin division.

Henri Dopchie and **Jacques Planquart,** two of the key members of Belgium's top-level atomic energy team, are now associated temporarily with the staff of Nuclear Development Corp. of America.

Edward Abrams has joined the staff of National Cylinder Gas Co.'s chemical preservative department. Abrams will head up the research and other scientific aspects of the section's activities.

Manuel N. Fineman has been appointed technical director for Puritan Chemical Co. He'll take charge of the expansion of the firm's technical research and development program as well as the maintenance of the standardization and control program.

L. Marshall Welch has been appointed director of research of the Petro-Tex Chemical



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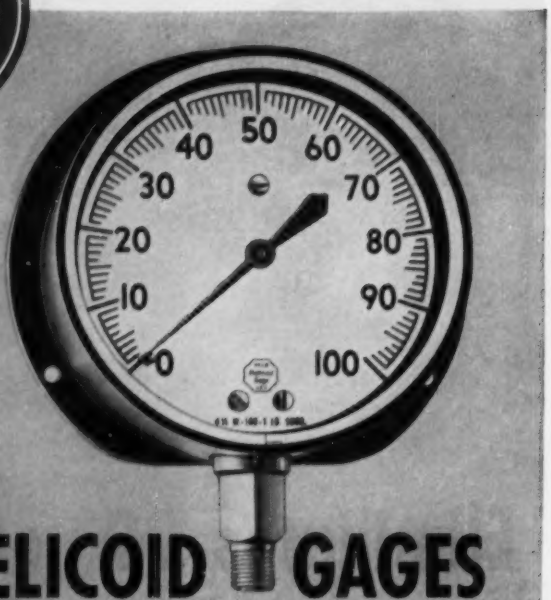

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NAMES . . .

Corp., with headquarters in the firm's Houston, Tex., laboratories.

Morris Jalazo has joined Pittsburgh Coke & Chemical as a project engineer in the design and estimating section of the engineering department, chemical divisions.

Earl F. Harris has been elected president of the Rodney Hunt Machine Co., Orange, Mass. **Carl C. Harris,** president since 1938, will continue to serve the company as chairman of the board.

Philip Freneau has been appointed to the newly created position of chief engineer of the manufacturing division of Southwestern Eng. Co., Los Angeles, Calif.

Charles L. Persyn has been moved into the job of superintendent of reforming and cracking for Tidewater Oil Co., at the Avon, Calif., refinery. **Howard L. Benson** has taken over Persyn's former job as superintendent of treating and lube oil manufacturing.

W. E. Kelley, president, Walter Kidde Nuclear Laboratories, has been elected a director of Walter Kidde Constructors, Inc.

Robert S. MacCormack has been named an assistant professor in the department of chemistry and chemical engineering at Stevens Institute of Technology.

Richard Hatfield with Southwest Research Institute in San Antonio for the past seven years, has joined Texas Butadiene & Chemical as group leader in the manufacturing, research and control laboratory.

Carl B. Yoder has been appointed senior engineer in the mechanical engineering department of U. S. Testing Co., Hoboken, N. J.

Domenic A. DiTirro has been named manager of research

and development for Valvair Corp., Akron, Ohio. He'll direct new product design, development and testing and will supervise the newly established research and development department.

William J. Ryan and **Morris L. Rosenfeldt** have been appointed vice-presidents of Water Service Laboratories, Inc., chemical engineers and specialists in water treatment.

Karl G. Davis and **Robert DiNapoli** have been appointed to the staff of the Tonawanda, N. Y., laboratories of Linde Air Products, division of Union Carbide & Carbon.

Mary E. Murphy and **John M. Rodakis** have joined Monsanto Chemical's technical staff in the Springfield, Mass., plastics division.

Edgar Morgenegg and **Robert Mendelson** have joined the division's research department in Texas City, Tex.

Carl D. Thomas has been appointed supervisor of the maintenance engineering section of the engineering department, chemical divisions, Pittsburgh Coke & Chemical Co.

Rudolf H. Thielemann has been named chairman of Stanford Research Institute's new department of metallurgy, in Menlo Park, Calif.

William F. Waldeck has been named to the newly created post of technical director for Shea Chemical Corp., Jeffersonville, Ind. His job is to direct the development of new products and processes.

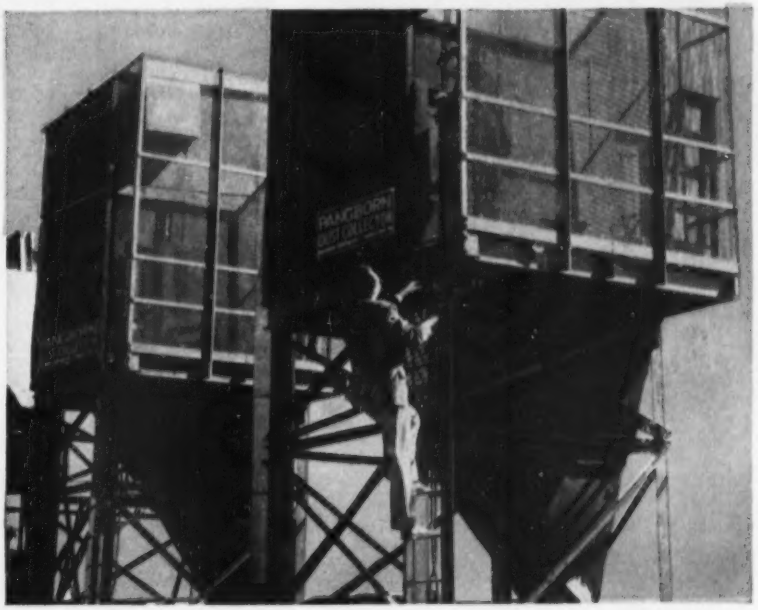
John B. Giacobbe, formerly plant metallurgist for Superior Tube Co., Norristown, Pa., has been appointed director of the firm's newly created nuclear products division.

Eugene P. Whitlow, one of the nation's experts in the field of refrigeration and air con-

General Tire & Rubber elects

Pangborn Dust Control for its plant

... and polls a saving of $75,000 a year!



General Tire and Rubber Co., Akron, Ohio, was losing hundreds of pounds of carbon black every day. To control this valuable ingredient in the manufacturing process, General Tire & Rubber installed five Pangborn Dust Collectors and gained three primary benefits. The firm maintains quality control in the manufacturing process by keeping ingredient quantities exact. In the winter the already-heated air can be returned to the plant and re-used after cleaning, resulting in high fuel savings. And finally—a tremendous cost advantage—Pangborn Dust Control permits salvage savings of approximately $75,000 a year!

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"You mean at Pritchard's test lab in Kansas City, Dad?"

"That's right. Remember I told you we make impartial tests on all known commercial filling now used in cooling towers as well as on many experimental types?"

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"We run them under actual operating conditions to find out which filling works the best. This Pritchard filling we're looking at here, meets or exceeds the performance of any other type of filling."

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"Yes, it does, Bob. Because we are constantly testing and measuring cooling tower performance, Pritchard engineers are able to make continuing improvements in tower design and can offer their customers a better performing cooling tower."

"Pritchard sure makes a good cooling tower, don't they, Dad?"

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"Yes, Bob, this is the Pritchard filling we developed at the lab."

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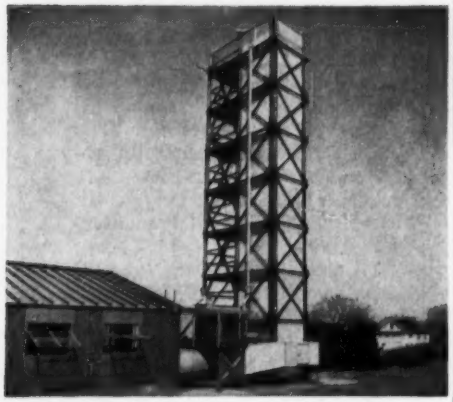

Performance studies conducted at Pritchard's cooling tower test facilities, prove that Pritchard filling performance is equal or superior to any other commercial design now in use in cooling towers.

Performance is not the only factor in Pritchard filling design. It is conservatively sized for years longer service. Pritchard filling is sturdy, permanently positioned, not easily damaged by high winds, ice loads or other operating conditions—yet is readily removable. Made of Clear All Heart redwood.

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NAMES . . .

ditioning, has joined Southwest Research Institute's department of chemistry and chemical engineering as senior physical chemist.

Sinclair Refining Co.'s manufacturing department has been reorganized into five new operating divisions with **R. E. Howe,** supervising processing; **J. E. Bell,** engineering and maintenance; **G. F. Kuhn,** refinery production; **K. A. Beach,** asphalt and chemicals; and **A. D. Hill,** lube oil production.

Richard W. Davis, chemist, and **Fred Davenport,** chemical engineer, have been added to the technical staff of Stauffer Chemical's Richmond, Calif., plant.

Thomas Baron and **F. M. McMillan,** have been named heads of the chemical engineering and polymer-chemicals departments, respectively, at Shell Development's Emeryville research center, Emeryville, Calif.

OBITUARIES

Earl L. Modesitt, 68, retired mining and oil executive, died July 19 at his Denver residence. Modesitt pioneered in the recovery of potash from the brine lakes in northwestern Nebraska in 1910-21. He had been president of Texas Potash and Union Potash & Chemical—both of which later merged with International Minerals & Chemicals.

Harold A. Sweet, director of the industrial division of Refined Products Corp., Lyndhurst, N. J., died after a brief illness. Before his association with Refined Products, he had served 34 years with General Dyestuff Corp., division of General Aniline & Film.

Madison L. Marshall, 50, died in Decatur, Ala., following a heart attack. Marshall had been a group leader of the applied physical chemistry group in Chemstrand's research and development department.

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CH_3NO_2

NITROETHANE
$CH_3CH_2NO_2$

1-NITROPROPANE
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2-NITROPROPANE
$CH_3CHNO_2CH_3$

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$CH_3C(CH_3)NH_2CH_2OH$

ALKYL NITRONIC ACIDS
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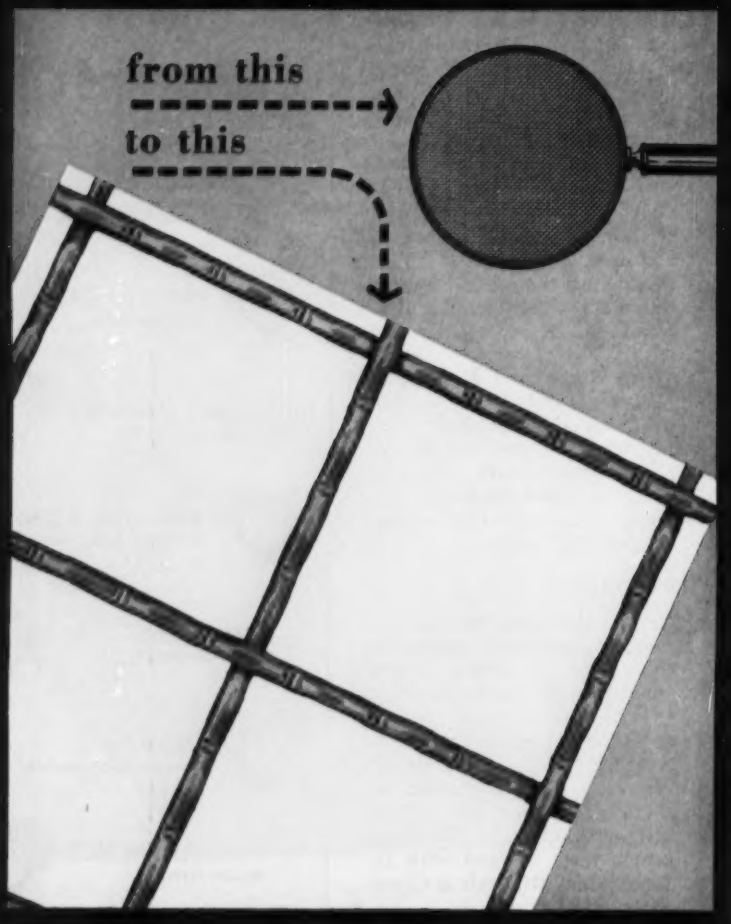

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Letters:

Crossflow vs. Counterflow

Sir:

The 32-page feature report on "Liquid-Gas Contacting" in your August issue (pp. 175-206) is a formidable presentation of a complex phenomenon.

But before someone gets too far off base, I believe your readers would appreciate one correction and a bit of elaboration with reference to the fifth paragraph in the second column of p. 195, in the section on water-cooling towers.

This paragraph states: "The crossflow design, generally referred to as Double-Flow . . . provides a longer air travel than with the conventional counterflow models."

To the contrary, the conventional counterflow design, with water falling downward and air movement substantially upward, limits the air travel only by the height of structure. In the crossflow design, with water falling downward and air traveling substantially horizontally, air travel is limited by thermodynamic design considerations to a distance of 18-24 ft. for commercial applications.

RAYMOND C. KELLY
Cooling Tower Institute
Palo Alto, Calif.

Pro: Standard Deviation

Sir:

Dale Davis' nomograph on p. 206 of your April 1956 issue is for *average* deviation, despite its name. Average deviation is an increasingly obsolete term in modern statistics. The *standard* deviation is a distinctly different and far more useful statistical tool. For example, see *Chem. Eng.*, March 1956, p. 166.

F. B. ODASZ
Husky Oil Co.
Cody, Wyo.

Sir:

The nomograph in question is actually for the standard and not the average deviation. It's really what Dean and Dixon

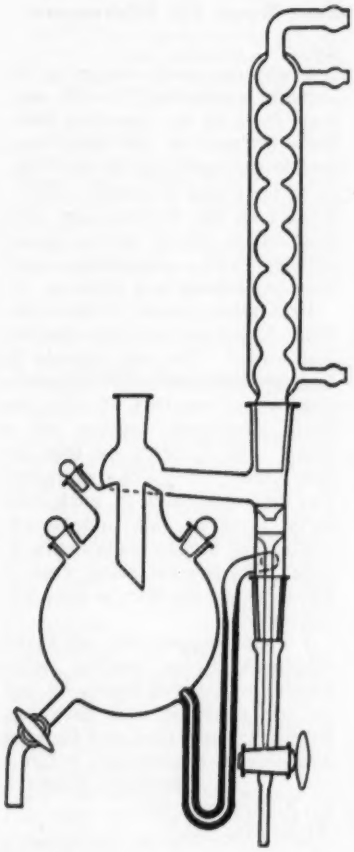
Pro & Con

C. H. CHILTON

(*Anal. Chem.*, **23**, 636, 1951) call the *estimated* standard deviation, which is close to the true standard deviation. In this Marple of MIT seems to agree (*Chem. Anal.*, **43**, No. 3, 83, 1954).

Incidentally, we've had more requests for reprints of this chart than for reproductions of any other nomograph published in recent years.

DALE S. DAVIS
University of Alabama
Tuscaloosa, Ala.



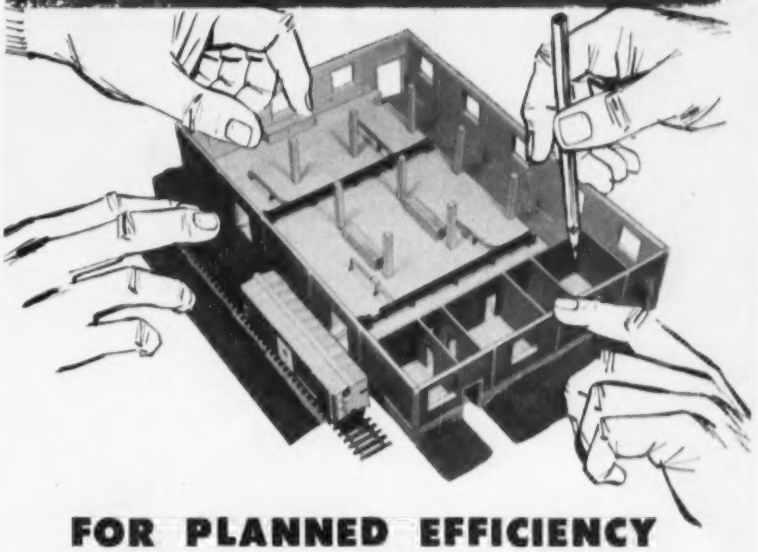
Still vs. Column

Sir:

I would like to call your attention to an editorial error on p. 180 of my recent feature report on "Liquid-Gas Contacting" (Aug. 1956, pp. 175-206).

The familiar and widely used modified Othmer still (*see cut*) should have been shown in the

Put 'er there...!



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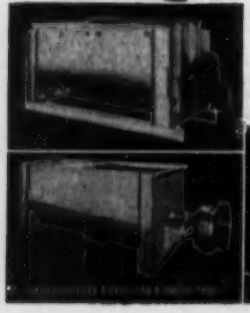

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PRO AND CON . . .

illustration, rather than the so-called "Othmer Column." Similarly, the reference in the text directly below the illustration, on the same page, should have referred to the still.

I believe it is important to correct this error, because the Othmer still remains the most simple, and in terms of usage, possibly the most important, technique for obtaining vapor-liquid equilibria data for practical design purposes.

RAYMOND E. VENER
Catalytic Construction Co.
Philadelphia, Pa.

Pro: Break for Filekeepers

Sir:

I clip a good majority of articles appearing in *CE* and keep them in my personal files. This is hard to do when one article is concluded on one side of a page and a second article started on the reverse side. My suggestion would be to space articles with advertising and give us filekeepers a break.

One other point. I find the Plant Notebook very informative and useful. The only trouble is finding this valuable information when required. I clip the Plant Notebook section as a whole, but it can't be filed or subdivided for quick reference. The valuable part of such material is to be able to take advantage of other people's experience. The present setup doesn't allow me to do this to best advantage.

I would suggest that all Plant Notebook items dealing with similar or related topics be put on one page, so that they can be clipped and filed and thus be available at a moment's notice.

DENNIS G. ROBERTS
C. F. Braun & Co.
Alhambra, Calif.

▶ *We don't mind at all when a reader calls our attention to the fileability problem. In fact, we consider it highly complimentary that our readers want to preserve our articles for future reference.*

Several years ago the problem reached such proportions that we completely redesigned the makeup of the magazine to achieve maximum fileability. These changes went into effect in January 1954.

For the past 34 months, all departmental material has been 100% fileable. The only exceptions are the departments with no particular permanent file value—Personals, Letters, Books and Firms.

On feature articles and reports, here are some significant statistics on fileability, reported as percent of total articles which could be filed as a unit without interfering with any other articles:

1953	22.7%
1954	62.4%
1955	72.2%
1956 (8 mo.)	74.5%

Makeup of Plant Notebook pages devoted to single subjects is a worthwhile ideal but would be extremely difficult—if not impossible—to achieve. Plant Notebook clippers can solve this problem individually by clipping apart the unrelated items appearing on the same page and pasting up their own Plant Notebook in scrapbook style.

Incidentally, our many Plant Notebook readers will be happy to learn that Editor Ted Olive has begun work on a book which will incorporate some 850 of the most valuable Plant Notebook items which have appeared over the past 25 years. It will be thoroughly indexed and cross-referenced.—ED.

Pro: Vapor Compression

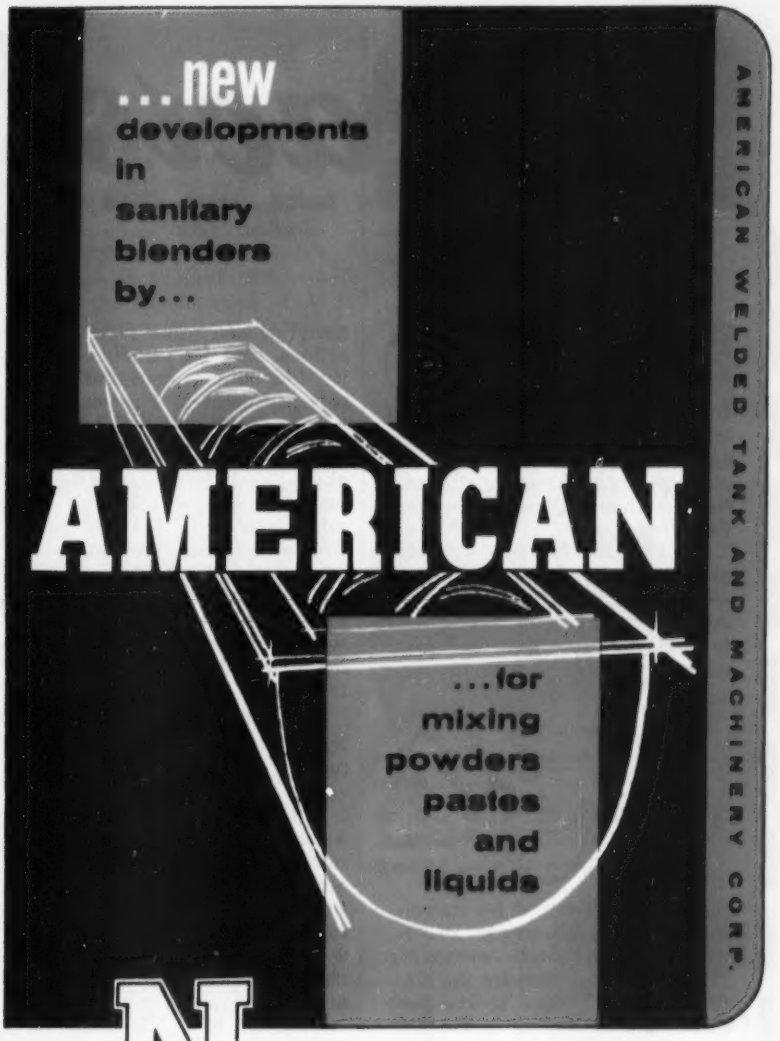
Sir:

We have just completed reading your 64-page report on Compression in the June issue of *Chemical Engineering* (pp. 175-238). This is an excellent report, and we would like to extend our appreciation to you for the compilation of this valuable information.

Although we have been investigating compression of water vapor in some detail, we have found many new and useful things in your report which will be of benefit to us.

Our particular interest was in the field of vapor-compression evaporation as related to industrial processes. We were a little disappointed that more wasn't said on this phase, although we realize your article was on compressors, not evaporators.

Recent advances in compressor design, coupled with advances in entrainment-separating devices, have placed a new light on vapor-compression evaporation. A number of large installations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...for distribution to all process industries, and research and developmental organizations, points out exclusive, money-saving, and time-saving improvements in basic design and construction of American's new line of spiral blenders. Exact specifications in light, medium and heavy duty blenders offered, plus information on special order design and service. Write for your free copy today.

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AMERICAN Welded Tank and Machinery Corp.
subsidiary WELDED TANK AND MACHINERY CORP.
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Care of_____

Xtracts

USEFUL INFORMATION ABOUT REACTIVE CHEMICALS FROM DU PONT ELECTROCHEMICALS DEPARTMENT

"PERDOX" Chases the Coffee Culprit from Plastic Ware

Increased use of plastic ware in homes and restaurants has intensified the search for an effective cleaner—one that will remove stubborn stains without damage to the plastic surface.

Du Pont has the answer to this problem in the form of "Perdox" sodium borate perhydrate. As the active ingredient in the new dip-type cleaning compounds on the market, "Perdox" makes for easy

removal of coffee and tea stains—the worst offenders on plastic ware. Alkaline compounds containing "Perdox" do not discolor the plastic, affect the surface, or lose their stain-removing ability in the presence of organic matter.

Stain-removers containing "Perdox" have cleaned up trouble for both the kitchen supervisor and the homemaker.

For more information about "Perdox" and its many applications, check the coupon.

Tetrahydrofuran—Intermediate and Powerful Solvent

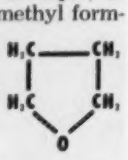
Best known for its high solvent power, tetrahydrofuran also has large scale uses as a chemical intermediate. A wide variety of reactions indicate the versatility of tetrahydrofuran, for example:

Oxidation ..... succinic acid
Chlorination 2,3-dichlorotetrahydrofuran
Hydrochlorination 4-chlorobutanol
Acylation ..... esters of 1-4 butanediol

In addition, THF is used in extraction and as a solvent medium, particularly for Grignard, sodium acetylide and other reduction reactions. Its ether structure, stability, low boiling point and solvent capacity point to a promising future for THF in both fields.

Tetrahydrofuran has an unusually high solvent action for the high molecular weight polyvinyl chlorides. Now, with THF as the active solvent, these hard-to-dissolve vinyl polymers can be considered and used as "solution resins" to produce improved top-coatings for supported fabrics and plastic sheeting, more durable protective coatings, and stronger films.

A colorless liquid, THF is readily miscible with water, ketones and most of the common organic solvents. Mixing with THF frequently improves the solvent power of weaker solvents. For example, at room temperatures dimethyl formamide dissolves less than 5% of one of the higher molecular weight polyvinyl chlorides and THF about 17%; yet a mixture of 65% THF and 35% DMF will dissolve about 24% of that same polyvinyl chloride to yield a solution of low viscosity. Solvent power can, of course, be increased by raising the temperature, and solutions of PVC in THF show little or no tendency to gel on storage.



Check the coupon for more information about this powerful solvent—its uses, applications and properties.

Speed Reactions, Improve Yields with Sodium Dispersions

Microscopic particles of sodium dispersed in an inert medium offer definite advantages over bulk sodium in many reactions. Yields are better, reactions faster—frequently at lower temperatures.

Sodium dispersions were first developed by Du Pont* and are particularly useful in systems where sodium is insoluble. In such cases, reaction time is a function of the sur-

face area of the sodium, and in dispersion form, the total surface area exposed is extremely large. Finely divided sodium dispersed in various media gives excellent reaction rates and yields in sodium-organic reactions, and makes possible many reactions which cannot be carried out with the solid or molten metal.

Find out more about sodium dispersions by checking the coupon.

U.S.P. 2394608—Applied for 1944

Try "ELVACET" for Low-Cost Coatings

This versatile, low-cost resin can help solve many coating problems on a wide variety of surfaces.

E. I. du Pont de Nemours & Co. (Inc.)
2526 Nemours Bldg., Wilmington, Del.

Please send me literature and information on: (CE-10)

- ☐ Sodium
- ☐ "Perdox" sodium borate perhydrate
- ☐ Tetrahydrofuran
- ☐ Formaldehyde
- ☐ "Elvacet" polyvinyl acetate

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...THROUGH CHEMISTRY

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. . . THROUGH CHEMISTRY

"Elvacet" polyvinyl acetate coatings—either clear or pigmented—on paper, cloth, wall and floor coverings are easily applied and air dried. Coatings adhere well . . . are stable to light and oxidation . . . are asphalt-resistant, and are not affected by aliphatic hydrocarbons, vegetable oils or animal fats.

"Elvacet" coatings will add greaseproofness and increase the abrasion resistance of paper and paperboard products . . . aid in eliminating odor pick-up from paperboard to contents . . . can be used as a base primer coat on fabrics for subsequent resin coatings . . . can be used as a pigmented base coat for oilcloth, wall coverings and floor coverings.

"Elvacet" is an easy-to-handle, high solids content, water emulsion. It does not require the use of expensive—and sometimes toxic or inflammable solvents . . . can be used "as is" or readily diluted, thickened, plasticized or otherwise compounded to give special properties. Excellent films are produced by evaporation of water.

The coupon below will bring you full information on "Elvacet".

Formaldehyde—
A Reactive Organic Chemical

Formaldehyde reacts with a wide variety of organic and inorganic compounds to make many interesting and useful derivatives. It takes part in many reduction, addition,

condensation, and polymerization reactions. Its methylene ($-CH_2-$) group functions as a "chemical button" to link similar or dissimilar molecules.

High purity 50% and 37% formaldehyde is available at low cost. Check coupon for information.

PRO & CON . . .

of vapor-compression evaporation equipment have been successfully completed which develop fuel economies unheard of in single-effect and multiple-effect evaporation practice. We would like to suggest that you consider the development of an article dealing with this relatively new industrial tool.

We were most interested in the section by Messrs. Bruce and Schubert which indicated that rotary-lobe compressors were available in sizes up to 50,000 cfm. and pressures up to 30 psig. This is above the range which we have been able to locate, and we would be most interested in knowing who manufactures this equipment.

M. P. GOODEN
American Viscose Corp.
Front Royal, Va.

▶ *Re vapor compression: We have been exploring the possibility of an article on vapor-compression evaporation. Mr. Gooden's remarks about successful large installations leads us to believe that such an article would be timely and useful.*

Re rotary-lobe compressors: The statement in the article was not meant to imply that there is an individual machine capable of delivering 50,000 cfm. at 30 psig., but rather that 50,000 cfm. is the maximum volume for any given machine now made and that 30 psig. is the maximum pressure for any given machine now made.—ED.

It Ain't Necessarily So

Sir:

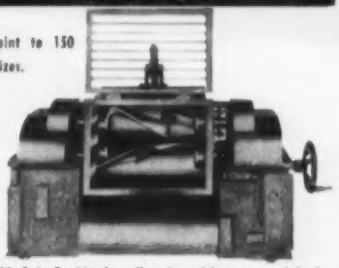
Regarding Mr. Strelzoff's article on nitric acid processes (May 1956, pp. 170-4), I consider it a very good article and feel that it covers the field very well.

Only one small item appears to need a little clarification. That is the fact that "complete power recovery plants" may not necessarily lead to lower operating costs, because the cost of preparing the feedwater may be greater than the equivalent electricity. Obviously, any steam put into the expander is going to be lost and, as a result, there must be 100% makeup. This can be expensive.

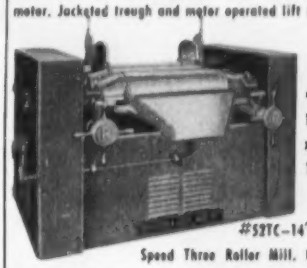
D. M. CARR
Chemical & Industrial Corp.
Cincinnati, Ohio

Ross
Leading mfrs. of
MIXING AND GRINDING EQUIPMENT
for over 90 years

• 1 pint to 150 gal. sizes.



#41L—10 Gal. Double Arm Kneader with two speed brake motor. Jacketed trough and motor operated lift optional.

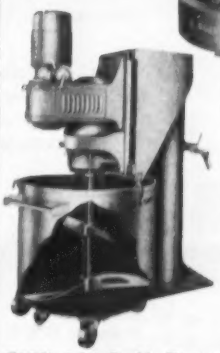


• 4½ x 10, 6 x 14, 9 x 24, 12 x 30, 14 x 32, 16 x 40" sizes.

#52TC—14" x 32" High Speed Three Roller Mill. Hydraulic adjustment and pressure recording gauges optional.

#30C—50 Gal. Heavy Duty Change Can Mixer. Adjustable outer scraper, cover with charging port, and gates on cans optional.

• 8, 16, 20, 50 and 60 gal. sizes.



#130H—250 Gal. Change Tank Mixer with hydraulic raising and lowering and variable speed motor. Various type stirrers and high speed impellers optional.

• 80, 150 and 250 gal. sizes.

#130EL—1 Gal. Double Planetary type Change Can Mixer with shearing action stirrers, and variable speed reversing type motor. Jacketed cans and portable trucks for cans optional.

• 1, 2, 3, 4, 6, 15, 25, 50, 65, 85, 110 and 150 gal. sizes.

Write for complete information on these or other types of Ross equipment.

CHARLES ROSS & SON COMPANY, INC.
152 Classon Ave., Brooklyn 5, N. Y.

New **ACE RIVICLOR®**
Corrosion-resistant plastic piping

RIVICLOR, newest of all rigid plastic pipe, heads the list for resistance to chemicals and excellent aging characteristics . . . plus high strength, toughness and easy workability.

Riviclor is unplasticized polyvinyl chloride, specially formulated for process piping. Non-toxic, non-flammable, excellent insulating properties. Only half weight of aluminum. Never needs painting. Smooth inner surfaces give you high flow rates with low loss of head.

Approved For Use With Drinking Water

Use Riviclor for all in-plant piping of mild or strong corrosives at normal temperatures . . . for liquid lines where "sweating" or corrosive vapors are problems . . . for underground piping. Pipe, fittings, diaphragm valves from ½" to 2".

Ask for Technical Bulletin CE-56.

ABBREVIATED TABLE OF CHEMICAL RESISTANCE

ACIDS		BASES		MISCELLANEOUS			
Acetic 50%	S	Ammonium Hydroxide 28%	S	Ethyl Alcohol	S	Carbon Tetrachloride	S
Chromic 25%	S	Sodium Hydroxide 50%	S	Methyl Ethyl Ketone	U	Plating Solutions	S
Hydrochloric 38%	S	HALOGENS		Gasoline	S	Photographic Solutions	S
Hydrofluoric 50%	L	Sodium Chloride Sat.	S	Mineral Oil	S	KEY: S—Satisfactory	
Nitric 20%	S	Ferric Chloride	S	Animal Oil	S	L—Limited to certain applications	
Sulphuric 50%	S	Sodium Hypochlorite 5%	S	Vegetable Oil	S	U—Unsuitable	
Sulphuric 98%	S			Phenol 10%	S		
				Chlorine 5%	L		
				Alum	S		

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
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Meet Your

Elmer L. Gaden, Jr.

FOAMS IN CHEMICAL TECHNOLOGY. PAGE 171

Elmer Gaden, associate professor of chemical engineering at Columbia University, New York, is a specialist on industrial biochemistry and microbiology, with the emphasis on fermentation. Readers will recall his particularly lucid Fermentation Report in our April 1956 issue. But his interests go beyond the primary fermentation process, including such matters as sterilization, radiation sterilization, and the separation and isolation of biochemical materials. We have his promise that in a few months he will supplement the Fermentation Report with another on separation and purification procedures.

Gaden's education was in the schools and colleges of greater New York. He started undergraduate work at Brooklyn Poly, finished work for his BS in ChE at Columbia in 1943. After receiving a reserve commission in the Navy he took radar and electronics training at Bowdoin and MIT, then served as radar officer with the Pacific Fleet. Following the war he returned to Columbia, receiving his MS in 1947 and his PhD in 1949. After a year with Chas. Pfizer & Co. in the bio-engineering group he returned to Columbia as assistant professor in 1949, and was appointed associate professor in 1954. At Columbia he has organized a program of courses and research in biochemical engineering, and

Authors...

is director of Columbia's radiation sterilization studies.

A member of the AIChE, ACS and Society of American Bacteriologists, Gaden is on the ACS's advisory board for the Fermentation subdivision. He is also on AIChE's program committee.

After hours Gaden's excess energy—of which he has plenty!—is absorbed in rebuilding an old house, personally doing the plumbing, heating, wiring, cabinet work, and even building some furniture. This has been his main relaxation since 1949 but he still finds time for another totally different hobby—the study of history and political science, particularly military history. In this connection he collects data and material on weapons, aircraft and ships and is building a collection of scale models of both.

Victor Kevorkian

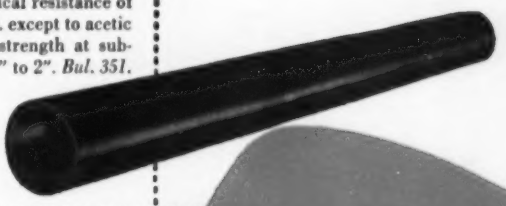
FOAMS IN CHEMICAL TECHNOLOGY. PAGE 171

Victor Kevorkian, co-author with Elmer Gaden of our Foams Report, is presently a graduate student in chemical engineering at Columbia University, New York. He is completing the work for his doctorate, conducting research on the physical chemistry of foams and particularly on the engineering design aspects of the foam fractionation process discussed in the Report.

Kevorkian's undergraduate degrees (BA in 1953 and BS in ChE in 1954) came from Columbia's college and school of engi-

STAYS TOUGH AT SUB-ZERO TEMPERATURES

ACE PARIAN . . . odorless, tasteless, rigid polyethylene. Best chemical resistance of any plastic at room temp. except to acetic acid. Excellent impact strength at sub-zero temp. Rigid pipe ½" to 2". *Bul. 351.*



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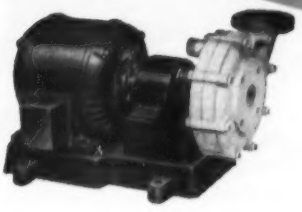
Rubber-lined by ACE
2-layer system

Economical, universal protection against all alkalis, metallic salts, practically all inorganic acids, hydrochloric acid any strength, sulphuric to 50%, nitric to 20%, phosphoric to 75%. Good to 160 deg. F. . . . sometimes higher. Soft rubber interlayer aids shock resistance.

Now eleven ACE Materials to STOP CORROSION

Eleven job-proved rubber and plastic materials now available in ACE piping, valves, pumps and tanks. Tough Ace-lite rubber-plastic blend . . . Saran . . . heat-resistant Tempron . . . Riviclor PVC . . . many others. Write for comparative properties Bulletin CE-50 . . . or call your American Hard Rubber Company distributor.



ACE "WAM" . . . THE FINEST
Non-metallic Acid Pump

On job after job, this 80-gpm. centrifugal pump has earned highest praise. Hard rubber casing and impeller, Hastelloy C shaft. Handles nearly all corrosives. Mechanically simple, trouble-free. *Bulletin CE-55.* Larger ACE pumps available.

NEED SPECIAL FITTINGS, COVERS, TANKS, PARTS?

If you want life-time corrosion protection for special parts needed in quantity . . . we may save for you by molding them of ACE hard rubber or plastics to your most exacting requirements. Our facilities among world's largest. Ask for recommendations.

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Keep "Down-Time" to a Minimum

CHEMPRO TEFLON PACKINGS

CHEMPRO TEFLON SEAL CAGES

If you are pumping or processing highly corrosive liquids and slurries, the Chempro Teflon† Packing-Seal Cage combination can drastically cut packing and shaft replacement, and keep your "down time" to a minimum. Pumping operations that formerly required daily repacking now operate continuously for months without repacking.

CHEMPRO TEFLON RING PACKING provides a frictionless, positive seal impervious to chemical attack. Chempro Styles 101 and 201 packing are available in ring sets, solid or split, to fit any pump or process equipment stuffing box.

CHEMPRO TEFLON SEAL CAGES for lubricating or cooling stuffing box packing are machined in a single flexible piece that snaps over the shaft, fitting snugly without vibration. They are non-scoring and corrosion-resistant, and last many times longer than metal lantern rings.

Ordering Information

1. Specify equipment make, model and size
2. Diameter of shaft
3. Bore and depth of stuffing box
4. Number of rings, solid or split
5. Material to be handled

THE ORIGINAL FABRICATORS OF TEFLON PACKINGS AND GASKETS

† duPont Trademark

CHEMICAL & POWER PRODUCTS, Inc.

5 Broadway, New York 4, N.Y.

AUTHORS . . .

neering. He continued graduate work at Columbia, earning his MS in 1956. He will shortly have completed the requirements for a doctorate in engineering science. During his schooling he has gained practical experience via summer work for Du Pont's Polychemicals Dept., at Belle, W. Va., and Esso Standard Oil Co.'s technical service division, at Linden, N. J. Later this year he plans to join the staff of the process research division of Esso Research & Engineering Co.

On the non-technical side, Kevorkian's activities run to color photography and the collecting of jazz and classical records, coupled with an interest in hiking and other activities that take him out of doors.

T. A. Kirkham

MORE FRESH WATER VIA MEMBRANES. PAGE 185

Oil and the propaganda of resurgent nationalism are but two of the streams flowing in the Middle East and Africa these days. Also of prime importance is the stream of fresh water that has started to flow on a commercial scale from saline sources.

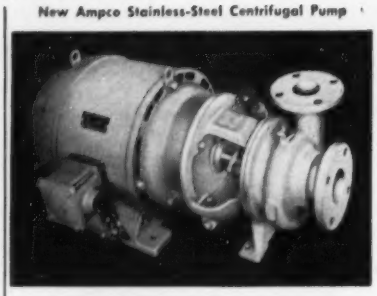
You gain real perspective on this development when like T. A. Kirkham, you've wrestled with the problem on the spot. Here's what he says following three trips to the region during the past three years:

". . . It is almost generally true that, wherever there is a need for fresh or demineralized water, the standard of living is low relative to that in the U.S.

You get an idea how strenuous it must be to bring water to these backward areas from

(Advertisement)

New Ampco Stainless-Steel Centrifugal Pump



New Line of Stainless-Steel Centrifugal Pumps

The Ampco "Z" line of stainless centrifugal pumps has been announced by Ampco Metal, Inc., Milwaukee 46, Wisconsin.

Although these pumps will be carried as stock items, they incorporate features which, until now, have been available only on special order for custom-built models.

A Series of Pumps

The new "Z" line is a series of high-speed, closed-impeller pumps for handling clear liquids and fine slurries that are not corrosive to GR.316S.S.

Pedestal assemblies are available for base-mounted coupling connections. Close-coupled connections fit NEMA standard pump motors.

Hydraulic range includes capacities to 600 gpm, heads to 160 ft.

Range of Combinations

Standard "Z"-series Ampco pumps are easily adapted to the particular requirements of specific applications. Deviations can include:

(a) Choice of materials for impeller, sleeve, rings, and pedestal.

(b) Choice of bearings — sealed, replenishable grease- or oil-lubricated, single or double rows.

(c) Choice of mechanical seals, and of internal or external lubricated stuffing boxes.

Because stock components can be interchanged, a pump can be altered in the field to satisfy new requirements when process conditions change. Obviously, this is more economical than replacing the complete pump.

High Efficiency

Working parts of Ampco "Z" pumps are shaped to conform to the natural pattern for imparting velocity and head energy to a fluid. This tends to check the damage caused by corrosives and abrasive slurries under the aggravating environment of highly turbulent flows with their high relative velocities.

Because destructive relative velocities are greatest where rotating and stationary parts are in close proximity, wear rings are inserted in the casings of Ampco "Z" pumps. Corrosion and erosion damage can be corrected by replacing the low-cost rings, instead of the more expensive casing and cover.

Likewise, the use of shaft sleeves eliminates the need for shaft replacement, saves time and maintenance costs.

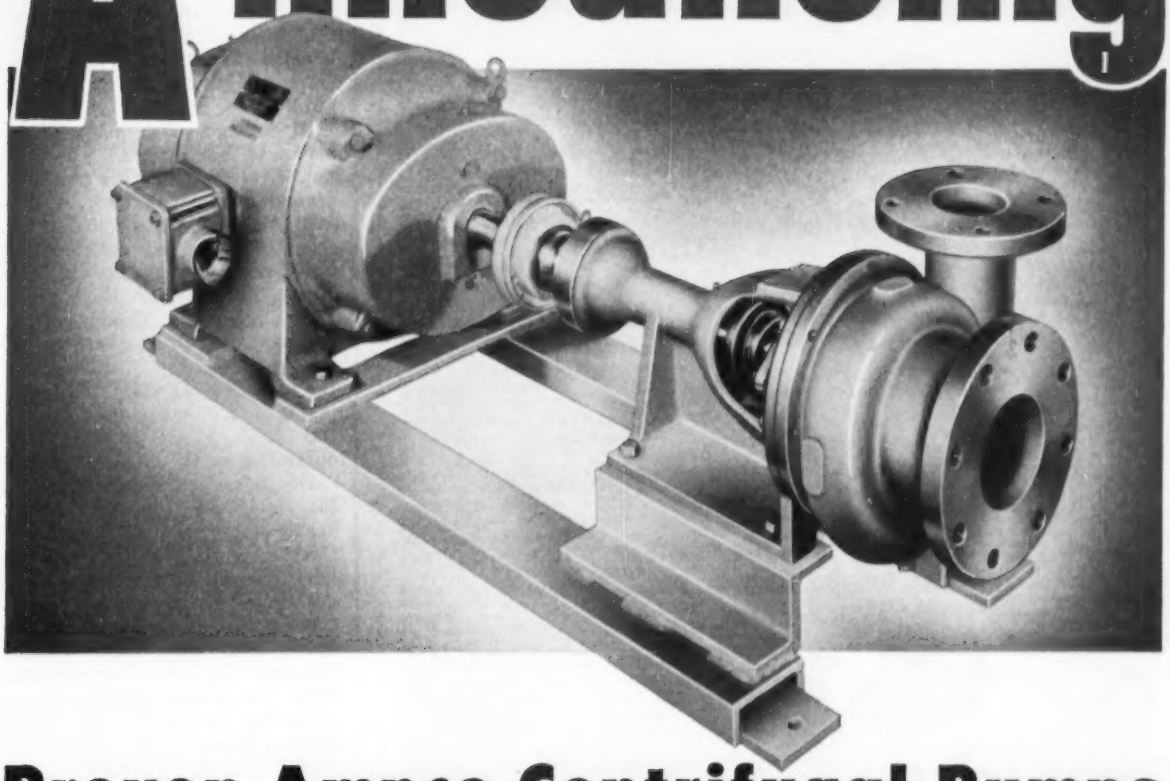
"Off-the-Shelf" Units

Ampco "Z"-series pumps will be stocked ready for shipment in as little as one day, depending upon adaptations required.

Complete parts inventories will be maintained for one-day shipment of repair and replacement parts.

Bulletin P-3C is available. For a free copy, fill out and mail the coupon on the opposite page . . . *Ampco Metal, Inc., Milwaukee 46, Wisconsin.* P-26A

Announcing



Proven Ampco Centrifugal Pumps in 316 Stainless

now available from stock

Now — all the exclusive "custom-built" features of proven Ampco alloy pumps are also available in standard Type 316 stainless steel.

1. "Off-the-shelf" stainless pumps with "correct-design" closed impellers — for greater efficiency, longer life.
2. "Off-the-shelf" stainless pumps with wear rings — to save the casing, prevent expensive repairs, reduce down-time.
3. "Off-the-shelf" stainless pumps with shaft sleeves— to give greater operating economy, eliminate worn shafts, cut maintenance costs.

Whether you specify these proven pumps in Ampco alloys or 316 stainless steel, you get versatility of selection, dependability, and economy unmatched in pumps today.

In their size range — capacities to 600 gpm, heads to 160 ft.—the *new* Ampco stainless-steel centrifugal pumps are the *best buys* on the market.

Let your Ampco distributor tell you more about these pumps. Or, send coupon for Bulletin P-3C.

AMPCO METAL, INC.
MILWAUKEE 46, WISCONSIN
West Coast Plant: BURBANK, CALIFORNIA

TEAR OUT COUPON AND MAIL TODAY!

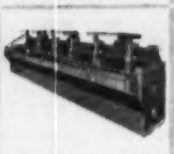
Ampco Metal, Inc.
Dept. CE-10, Milwaukee 46, Wisconsin

Send me Bulletin P-3C.

Name .....
Company Name .....
Address .....
City ..... Zone ..... State .....

CE-10

DENVER PROCESS EQUIPMENT

DENVER (patented) SUPER AGITATORS and MIXERS		3'x 3' to 20'x 20'	Patented standpipe around propeller shaft assures positive agitation and circulation. Patented wearing plate prevents sand-up on shut-down. Heavy duty as well as acid proof construction is available in both open-type, air lift and Super Agitator models. Please write for Bulletin No. A2-B4.
DENVER Steel-Head BALL MILL		3'x 2' to 7'x 14'	A Denver Steel-Head Ball Mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Laboratory and pilot plant mills also available. Please write for Bulletin No. B2-B13.
DENVER Automatic SAMPLERS		16" to 60" Cutter Travel	Heavy duty units, extra rigid track and ball-bearing wheels assure positive travel and timing of sample cutter. Available in stainless steel for acid and corrosive service. Wet and dry cutters. Central Control Panel for multiple samplers. Bulletin No. S1-B4.
DENVER Forced-Feed JAW CRUSHER		2¼"x 3½' to 36"x 48"	Cast Steel Frame, manganese jaw and cheek plates. Large diameter shafts reduce shaft deflection and thus increase life of heavy-duty, oversize roller bearings in bumper. Setting easily controlled. Please write for Bulletin No. C12-B12.
DENVER Wet Reagent FEEDER		0 cc to 2000 cc	Accurately meters minute quantities of liquid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of feeder to bulk storage device. Handwheel adjustment to control amount of liquid is simple and accurate. Used in multiples for higher capacities. Please write for Bulletin No. F6-B9.
DENVER Disc FILTER		1 Disc, 2' to 12 Disc, 9'	Special, patented design of segments in Denver Disc Filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, with no blow-back. Simple, low-cost, dependable construction. Quick delivery. Also Drum and Pan Filters. Please write for Bulletin No. FG-B1.
DENVER "Sub-A" FLOTATION		Laboratory and Commercial	Flotation is the selective separation of particles from each other in a liquid pulp by means of air bubbles. More large plants are installing Denver "Sub-A's" for their entire flotation job, because they give maximum recovery at a low cost per ton. Dependable, low-cost, simplified continuous operation. Please write for Bulletin No. F10-B81.
DENVER Wilfley Concentration TABLES		5 to 150 T/24 Hrs.	A mechanically operated, longitudinally reciprocating table consisting of a deck having a plane surface partly riffled and a tilting device. It separates materials into bands and handles the coarsest sands with excellent results. Ideal for separation of groups of particles having a similar range of specific gravities. Write for Bulletin No. T1-B3.
DENVER LABORATORY EQUIPMENT		Batch or Continuous	Batch and continuous test models of Crushers, Screens, Ball Mills, Pulverizers, Rod Mills, Classifiers, Agitators and Mixers, Pulp Distributors, Feeders, Flotation Machines, Pumps, Thickeners, Filters, Dryers, Tables, Samplers. Results obtained on Denver Laboratory Equipment can be duplicated by commercial machines. Please write for Bulletin No. LG3-B10.
DENVER Standard DRYERS		2'x 15' to 5'x 40' and larger	Available in several types: Direct Heat, Indirect Heat, and Steam Tube. Let DECO Engineers solve your drying problem. No dryer problem too small or too large. Please write for Bulletin No. D4-B2.

"The firm that makes its friends happier, healthier and wealthier"

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AUTHORS . . .

Kirkham's comment that he has all but abandoned pleasurable spare-time activities for lack of spare time. Among the hobbies that have withered on the vine is sailing, first in MIT dinghies, later in a Lawley 110 at Marblehead, Mass.

In common with many engineers in their 30's, Kirkham sandwiched engineering training around military service. As an enlisted Navy meteorologist, he spent the third year of his service tracking typhoons in the North Pacific, Far East area. Then, returning from service, he completed his schooling at MIT in 1948 with a BS in ChE. He attended the first engineering practice school opened at Oak Ridge, Tenn., by MIT, later obtaining an MS degree in 1949.

During practice school training and the following three years with Union Carbide & Carbon Corp. at Oak Ridge, Kirkham engaged in the basic design of the newer and larger type gaseous diffusion plants constructed at Oak Ridge, Paducah, Ky., and Portsmouth, Ohio. He is now director of engineering for Ionics, Inc., Cambridge, Mass.

Leonard Schwab

CUT REPAIR TIME AND COSTS WITH ALERT DESIGN. PAGE 190

Like his collaborator, B. G. Earnheart, Leonard Schwab speaks with authority on the relationship of design to maintenance.

Following graduation from Texas A & M College, he joined Monsanto Chemical Co. at Texas City, Tex., where for two years he was an area engineer, working with prime contractors on

two major and many minor construction projects.

With this construction experience under his belt, Schwab then switched to maintenance work. His first assignment was as an area engineer in direct charge of maintenance work in various units. Later, he became supervising engineer in responsible charge of maintenance work in several areas.

At present, Schwab is chief planner of the maintenance department at Texas City.

B. G. Earnheart

CUT REPAIR TIME AND COSTS WITH ALERT DESIGN. PAGE 190

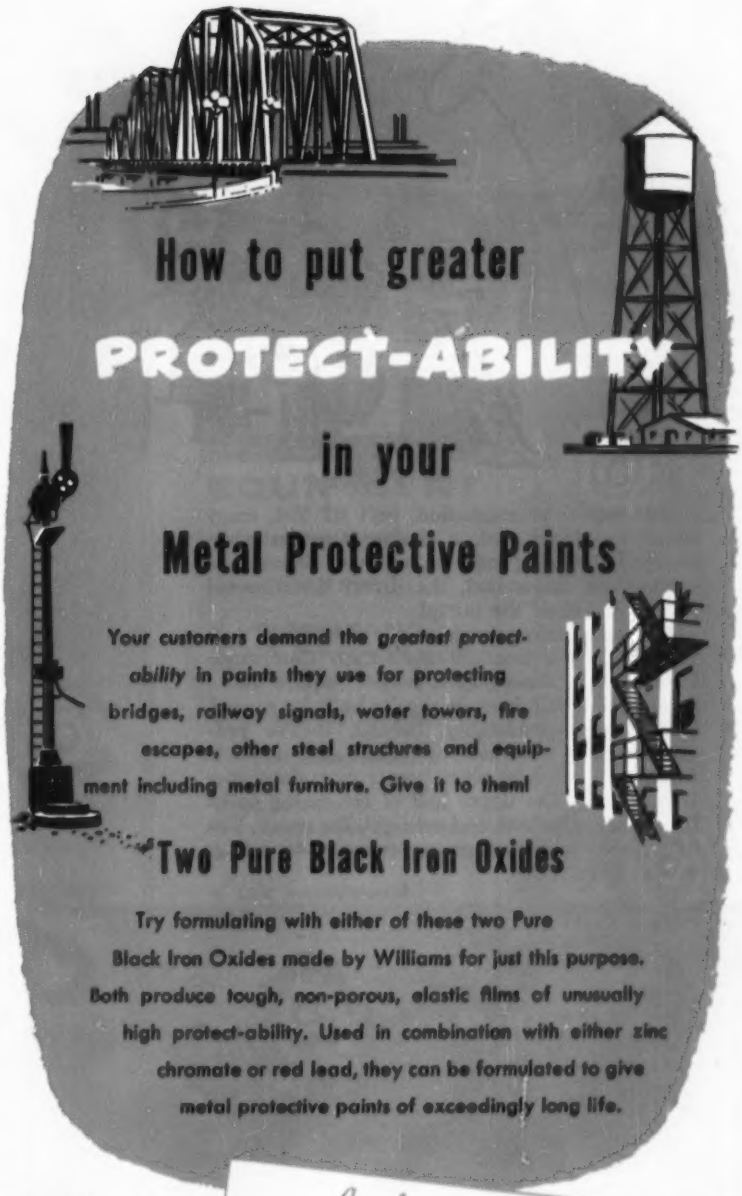
Experience gained actively in design, construction and maintenance prompted B. G. Earnheart and his collaborator, Leonard Schwab, to point the way to easy maintenance through alert design.

Earnheart's construction career started with the Corps of Engineers, U. S. Army, during World War II. All told, he spent two years in the European theater doing general military construction work.

After earning his BS degree in ME in 1947 at Texas A & M College, Earnheart joined Monsanto Chemical Co. at Texas City, Tex.

During the first year at Monsanto, he assisted in design work on rebuilding after the Texas City disaster in 1947. Then, for four years he was a supervising engineer, working with prime contractors on two major construction projects and many minor projects.

Since 1953 he has specialized in maintenance. First, he was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Fineness thru 325	99.5
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Avg. Diameter	0.4 microns

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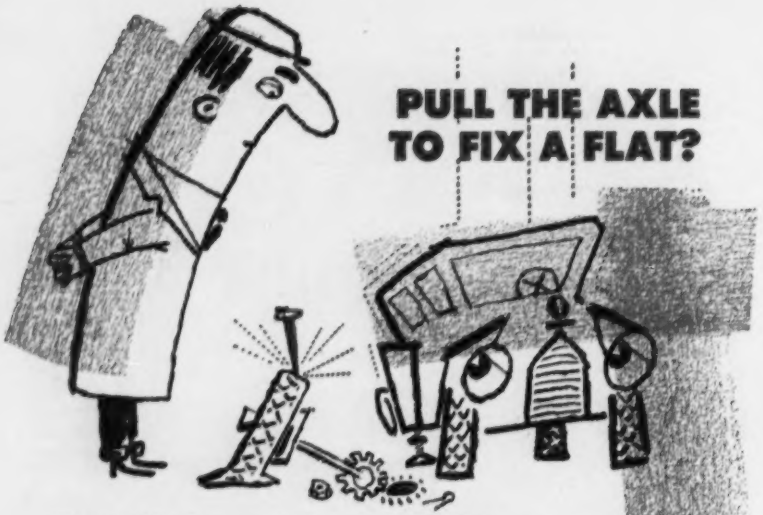

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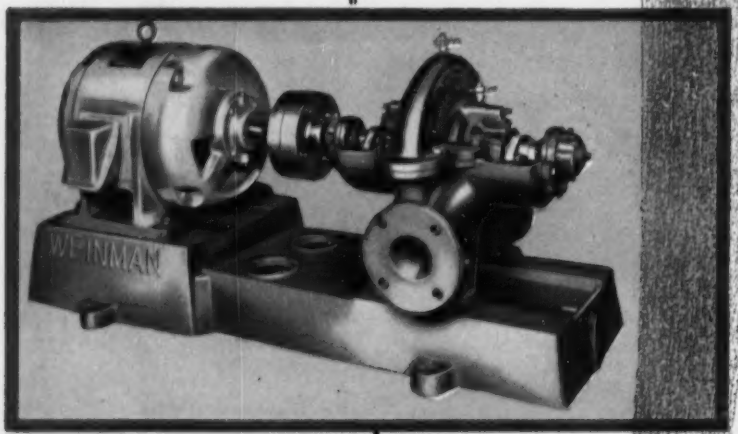

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AUTHORS . . .

an area engineer in direct charge of maintenance work in various units. Then, he became zone supervisor in responsible charge of maintenance work in several areas. Now, he is maintenance superintendent at the Texas City Plant.

Earnheart is a licensed professional engineer, State of Texas, and is a member of ASME.

Charles A. Rohrmann

REMOTE OPERATIONS IN U-235 PROCESSING. PAGE 195

Charles A. Rohrmann is a senior chemical engineer in the engineering department of GE's Hanford Atomic Products Operation, Richland, Wash.

With eight years of extensive experience in uranium process work, Dr. Rohrmann is well equipped to discuss the many complex engineering problems involved in separating uranium from spent reactor fuel.

He is responsible for the preparation of economic information which management applies in making major expansion decisions at HAPO. Also, he supervises a group doing process engineering (economic studies, process improvement) work for separation processes.

Primarily a process man, he joined GE after nine years of experience with Du Pont. There he worked in process development and plant supervision for the production of specialty and heavy chemicals.

He came to Du Pont from Ohio State, after receiving a PhD in chemical engineering.

Rohrmann co-authored a paper on high-level, radioactive waste disposal, presented at the

August 1955 Geneva Conference on Peaceful Uses of Atomic Energy.

The proud owner of a 30-acre farm outside Richland, he spends much of his "spare" time in youth counselling activities with the AIChE, ACS, YMCA and 4-H clubs.

Ralph A. Troupe

INSTALL THE RIGHT-SIZE ORIFICE. PAGE 199

When he sent us this article Dr. Troupe wrote:

"While no new formulas are presented in the attached article, the use of the formulae is unique and useful. I have utilized this system in industry as well as here at Northeastern and have found that it works very well."

Dr. Troupe is certainly well qualified to hold his post as research professor of chemical engineering at Northeastern University, Boston, Mass. His experience covers the entire scope of chemical engineering from a graduate assistantship at VPI in 1939 to technical superintendent for the Goodyear Synthetic Rubber Corp. in 1954.

He has a rich academic and industrial background to draw upon. He took his BS in ChE from Drexel Institute in 1939 and added the MS in 1940 at Virginia Polytechnic. During World War II he spent four years as a production engineer and supervisor with the synthetic rubber division of General Tire & Rubber Co.

After the war he journeyed to the great state of Texas to teach, become a registered professional engineer and to gain the PhD degree at the University of Texas in 1949.

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AUTHORS . . .

again, he stopped at the University of Louisville as associate professor of chemical engineering. Now, after five years with Goodyear, he's back in Boston where in addition to his consulting work, research and teaching, he finds time to serve the Boston section of AIChE. This year he is treasurer of the section and is taking an active part in planning the annual national meeting of the Institute which will be held in Boston early in December.

Just past his 40th birthday, Troupe's resume already runs to several closely-typed pages.

Bernard M. Goodwin, coauthor of this article is a 1956 graduate of Northeastern University. He is presently employed as a research assistant in the department of chemical engineering. This fall he will enter MIT to pursue a program for the MS degree in chemical engineering.

William F. Hartwick

IMPROVE YOUR COMPRESSOR DESIGN WITH NEW CALCULATION METHOD. PAGE 204

William F. Hartwick is an engineer in the technical division of the Cooper-Bessemer Corp.'s gas engineering section at Mount Vernon, Ohio.

A practical mechanical engineer, he's worked on a wide range of compressor problems: thermodynamic solutions to unusual compressor applications; field testing and trouble shooting; development and research work; economic studies; developing and simplifying calculation methods; sales consulting.

He joined Cooper-Bessemer directly after obtaining a BS in

mechanical engineering from Michigan College of Mining & Technology in 1948.

Since then he's been awarded a Professional Degree of Mechanical Engineer from the same school in 1955, and became a registered professional engineer in Ohio in 1954.

R. A. Lula

IMPROVED ELEVATED TEMPERATURE STRENGTH. PAGE 236

R. A. Lula, a native of Romania, has degrees in metallurgy from the University of Bucharest and Carnegie Institute of Technology.

He joined Allegheny Ludlum in 1950 after having worked as a metallurgist in Europe.

Adolph J. Lena

IMPROVED ELEVATED TEMPERATURE STRENGTH. PAGE 236

Adolph J. Lena is associate director of research—physical metallurgy, at Allegheny Ludlum, Brackenridge, Pa.

He received a BS degree from Penn State University in 1948 and two years later his MS de-

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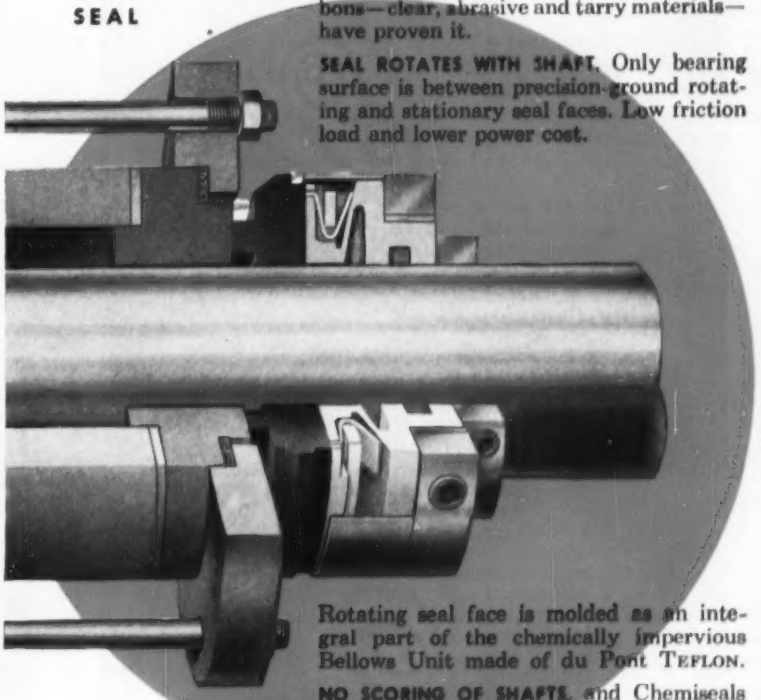

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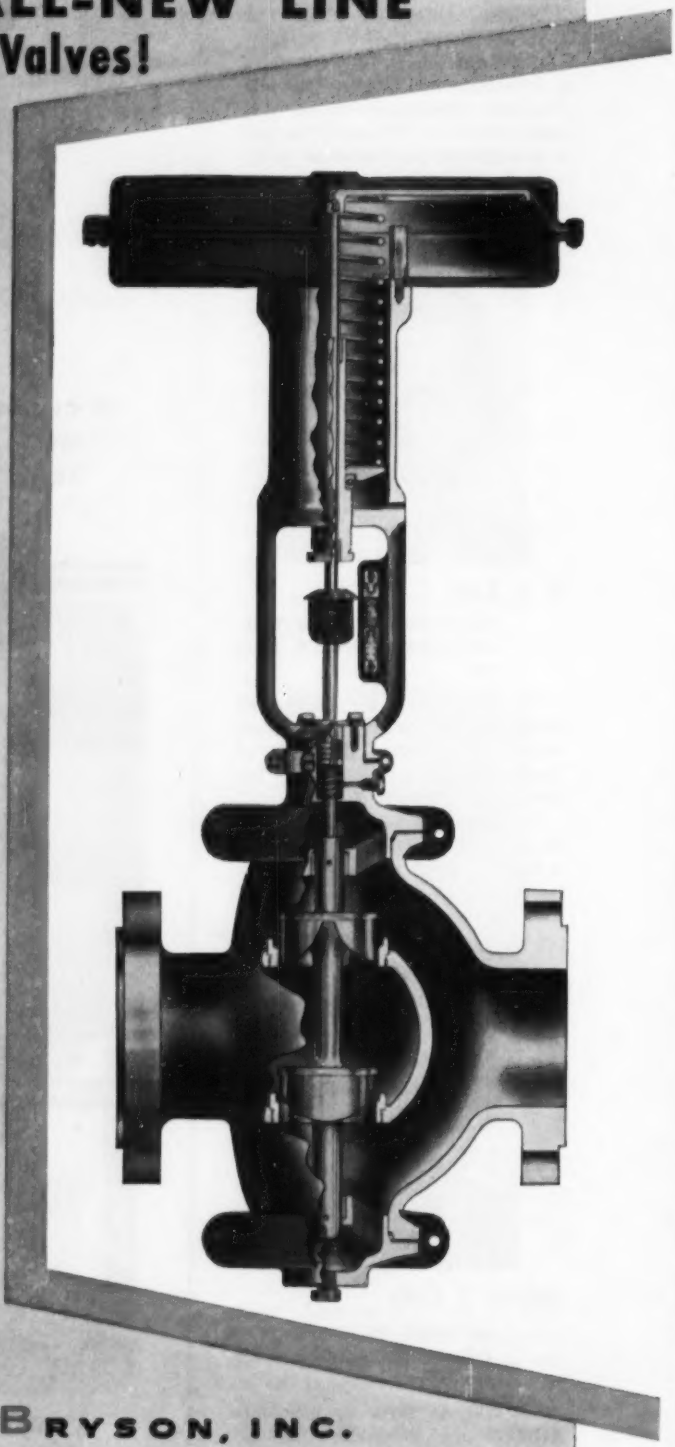

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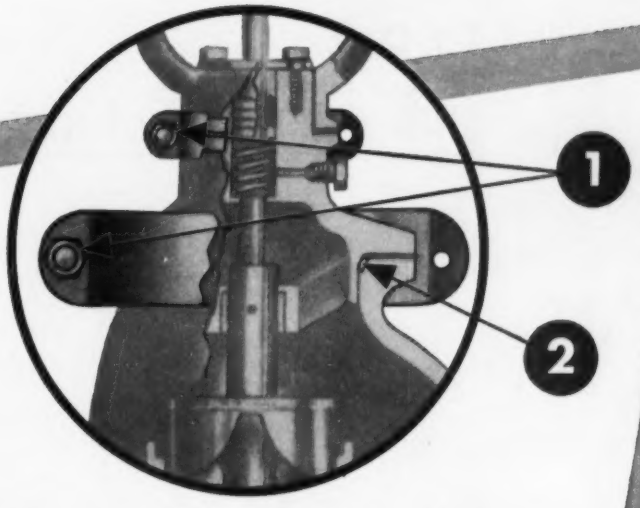

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AUTHORS . . .

gree from Carnegie Institute of Technology. In 1952, he received his doctorate from Carnegie Tech.

Following graduation in 1952, Dr. Lena joined Allegheny Ludlum Steel Corp. in the stainless steel section of the research laboratories. For two years he worked on the development of new stainless steel alloys and during this time he discovered a new stainless alloy called AM-350.

In 1954, Lena was named associate director of research and put in charge of a physical metallurgy group working on stainless, electrical and tool steels.

He's the author or co-author of numerous papers dealing with stainless steel metallurgy.

In October 1954 he received the Frank B. Lounsberry Award for his research paper, "Some Effects on Chromium Manganese Stainless Steel at Rolling Temperatures."

H. M. Johnson

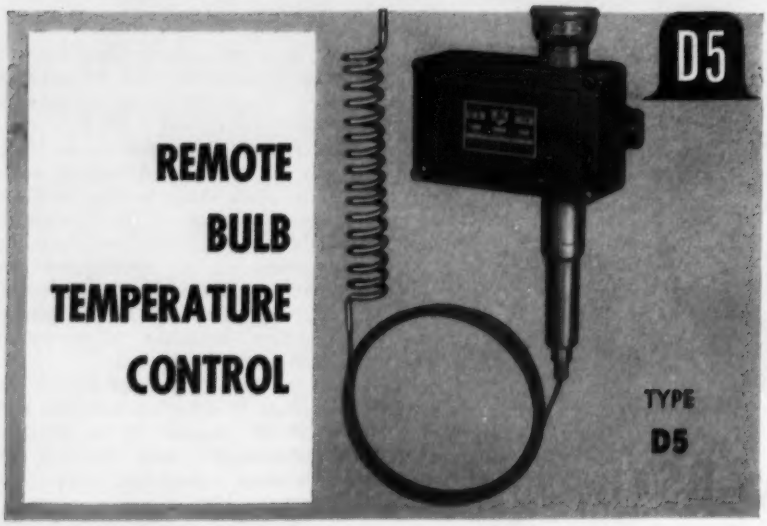
IMPROVED ELEVATED TEMPERATURE STRENGTH. PAGE 236

H. M. Johnson came to the research laboratory of Allegheny Ludlum Steel at Brackenridge, Pa., following completion of schooling in Pennsylvania.

He is a research metallurgist in the stainless steel section of the laboratory and a member of the Pittsburgh chapter of AMS and SESA.

He served in the European Theater of operation during World War II with a chemical mortar batallion. Now he is an active member in the VFW and other social organizations.

MICROMETER-ADJUSTED



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THIS MONTH'S

Technical

Valuable Tool

ION EXCHANGE TECHNOLOGY. Edited by F. C. Nachod and G. Schubert. Academic Press, New York. 660 pages. $15.

Reviewed by M. Mendelsohn

The role of ion exchange resins in industry has been covered in several reviews and books, but never so extensively and clearly as in Nachod's and Schubert's excellent volume.

In all, there are twenty chapters, each contributed by specialists in their fields and accompanied by comprehensive bibliographies.

Of particular interest to this reviewer were two chapters—one, by K. S. Spiegel, devoted to ion exchange membranes; the other, on ion exchange in water treatment by Calman and Kingsbury.

The inclusion of Spiegel's chapter is particularly pertinent because of the growing industrial applications of ion exchange membranes—e.g., as separators in batteries. Spiegel, however, deals mainly with their use in the desalting of water and describes membrane potential measurements in highly dilute solutions. And one might have wished for some description of membrane potential measurements in concentrated solutions.

Calman's and Kingsbury's chapter on ion exchange in water treatment covers, in detail, the most important single application of ion exchange resins. The problem of bacterial contamination of resin beds should, however, find a solution other than the ones mentioned—chlorination or sterilization.

For example, interesting experiments have been conducted to obtain ion exchange resins with bactericidal activity. True, as Kumin and Garvey point out, such resins are still laboratory curiosities. But they may one day have industrial potential.

In addition to the above, an extremely interesting chapter, by

Bookshelf

EDITED BY R. K. GITLIN

H. G. Swope, is devoted to treatment of radioactive waste.

Although several of the text's statements are speculative, they are challenging to chemists and chemical engineers. And this volume, with its treasure of information, should prove an invaluable tool to all persons concerned with ion exchange problems.

Bigger and Better

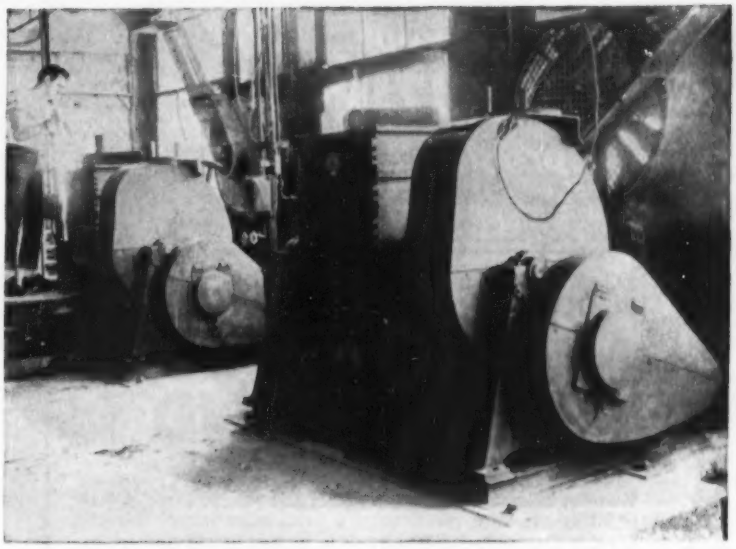
CONDENSED CHEMICAL DICTIONARY. 5th ed. Edited by A. Rose and E. Rose. Reinhold Publishing Corp., New York. 1,222 pages. $12.50.

After six long years, an old friend—in new garb—has returned to the chemical scene. And a welcome addition it is, too—particularly if you've had a rough time keeping up with the fund of new chemicals of commerce which have appeared on the market since 1950.

This latest edition of the "Condensed Chemical Dictionary" is bigger and better than any of its predecessors. Though we haven't gone through every single item, here are a few vital statistics:

- Over - all appearance — Somewhat larger type face, more legible.
- Contents — Numerical list of manufacturers (355 compared with 400 mentioned in the 4th edition), alphabetical list of manufacturers, transportation of explosives and dangerous articles, safety information (warnings and labels), trademarks.
- Size—1,222 pages (compared with 720 in the 4th edition). The percentage increase in pages varies from 37.7% for "A" to 100% for "V." And the average increase per section is 64.9%.
- Cost — About 1¢/page, a real bargain for such a handy reference.

The editors are to be commended for the time and effort put into amassing this fund of information and in expanding the scope of the dictionary.



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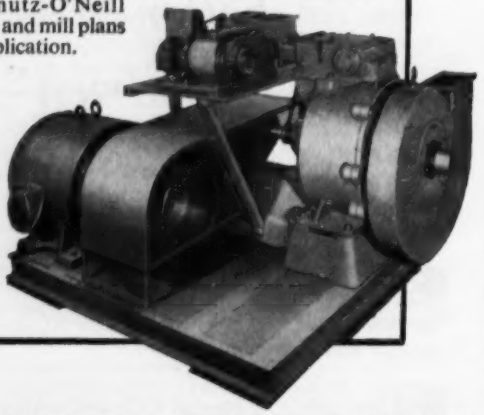

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Briefly Noted

MINERAL RESOURCES POLICY. 154 *pages.* $1.50. *The Secretary, Institution of Mining and Metallurgy, 44 Portland Pl., London W.1., England.* Record of six papers presented at a symposium sponsored by the Institution of Mining and Metallurgy in September, 1955. Covers mineral resources strategy, mineral development and research in the U. S. and Canada, aspects of mineral industry in East Africa, how Canada aids its mineral industry, economic consideration in British mineral resources policy, proposal for a central ore treatment laboratory.

RECOMMENDED EQUIPMENT AND PROCEDURE FOR THE PALLETIZED LOADING AND SHIPMENT OF REFRACTORY PRODUCTS. 46 *pages.* $1.50. *Refractories Institute, First National Bank Bldg., Pittsburgh 22, Pa.* Manual—containing text and sketches—covering standard wooden pallet; palletload protection; carloading patterns; palletizing insulating firebrick and bulk materials in bags, drums, cartons; standard wooden end gates; method of carloading empty pallets for return shipment; quantities of brick per pallet.

PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON RESERVOIR EVAPORATION CONTROL. 99 *pages.* $5. *C. W. Smith, Southwest Research Institute, 8500 Culebra Road, San Antonio, Texas.* Record of the April, 1956, conference held in San Antonio and jointly sponsored by the Southwest Research Institute and the Southwest Cooperative Project on Reservoir Evaporation Control. Includes discussion of control techniques—notably via hexadecanol, monomolecular film technique, construction of reservoirs with maximum average depth, concentration of water into single reservoirs, elimination of shallow water areas,

elimination of water growth, roofs and floating covers, windbreaks.

ANNUAL REPORT ON THE ACTIVITIES OF THE DECHEMA FOR 1955. 44 *pages. DECHEMA Deutsche Gesellschaft fur chemisches Apparatewesen, Frankfurt am Main W 7, Postfach, Germany.* Includes a summary of lectures and meetings organized or sponsored by DECHEMA in 1955, activities of the DECHEMA-Institut fur Aparate- und Stoffkunde (documentary work in the chemical apparatus and equipment field), results of the ACHEMA XI Chemical Apparatus and Equipment Congress Exhibition (May, 1955), activities of the Max Buchner Foundation.

CLARIFICATION, SEDIMENTATION AND THICKENING EQUIPMENT — A PATENT REVIEW. 208 *pages.* $2. *By W. L. Barham, J. L. Matherne and A. G. Keller. Engineering Experiment Station Bulletin No. 54. College of Engineering, Louisiana State University Agricultural and Mechanical College, Baton Rouge, La.* Survey of patents issued from 1849-1954 which are pertinent to the treatment of suspensions via flocculation, sedimentation and/or thickening. Includes illustrations of equipment.

TRADING UNDER THE LAWS OF GERMANY. 231 *pages.* $3.50. *German American Trade Promotion Office, 350 Fifth Ave., New York 1, N. Y.* Contains eight chapters devoted to basic features of German law, contracts, agency, partnerships and corporations, industrial property, negotiable instruments, bankruptcy and receivership, courts. Appendix covers treaty of friendship, commerce and navigation between the Federal Republic of Germany and the U. S.

SEARCHING THE CHEMICAL LITERATURE. 184 *pages. Advances in Chemistry Series No. 4. American Chemical Society,* 1155 *Sixteenth St. N. W., Washington, D. C.* Collection of papers presented at a symposium on searching the chemical literature held by the ACS division of chemical literature in April, 1950. Also included are four revised papers from the symposium on the preparation of literature and patent surveys held by the chemical education division in April 1947. Covers U. S. and British index entries, German chemical litera-

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Please send complete resume, including details of education and experience, to:
Mr. T. J. Donovan
Engineering Department

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Better Things for Better Living ...through Chemistry

E. I. du Pont de Nemours & Co., Inc.
Wilmington 98, Delaware

Standardaire Blower unloads 20 tons of flour in 50 minutes

In the next 50 minutes, this one operator will have unloaded twenty tons of flour from this huge International Milling Company trailer directly into a baker's storage bins.

The problem of rapidly unloading flour in such quantity, with no leakage, clogging or contamination, was solved by a *Standardaire* blower . . . the only blower found capable of meeting all the specific requirements involved.

This blower (shown in the front of the van) occupies a floor space of only 26″ x 21¾″. When driven by a 20 hp motor it provides an air flow sufficient to move flour as far as 125 feet in any direction . . . including straight up.

Today, due to its proved satisfactory performance, International Milling Company, Minneapolis, one of the largest millers of bakery flour in America, has equipped its entire fleet of bulk flour trucks with *Standardaire* blowers.

A *Standardaire* blower will deliver more air, with less power consumption, than any other unit of equal size or weight. Find out about its many advantages. Write for bulletin B-154 today.

READ STANDARD
CORPORATION

BLOWER-STOKER DIVISION
370 LEXINGTON AVENUE, NEW YORK 17, NEW YORK

ture, theses and dissertations, U. S. chemical patents, chemical trademarks, foreign chemical patents, etc.

EXPERIMENTAL MEASUREMENT OF THERMAL CONDUCTIVITIES, SPECIFIC HEATS AND DENSITIES OF METALLIC, TRANSPARENT AND PROTECTIVE MATERIALS. *Part* 1, 136 *pages.* $3.50. *Part* 2, 39 *pages.* $1. *Part* 3, 78 *pages.* $2. *Office of Technical Services, U. S. Dept. of Commerce, Washington* 25, *D. C.* Part 1 includes a literature survey of methods and apparatus for thermal measurements and an extensive bibliography on thermal conductivity, thermal expansion, specific heat, density. Part 2 contains measurments of thermal conductivity of Plexiglas and Pyrex. Part 3 deals with thermal conductivity calculations for plate glass and other transparent solids.

SIGNIFICANCE OF ASTM TESTS FOR PETROLEUM PRODUCTS. 115 *pages.* $2.50. *American Society for Testing Materials,* 1916 *Race St., Philadelphia* 3, *Pa.* Outlines the significance and limitations of various ASTM test methods for petroleum products. Each chapter discusses a particular property or characteristic covering the importance of sampling, selection of test apparatus, methods of test which apply and their significance. Prepared for petroleum executives, scientists, engineers, lab technicians.

HOW AMERICAN STANDARDS ARE MADE. 19 *pages. American Standards Assn., Inc.,* 70 *E.* 45*th St., New York, N. Y.* Discusses history, objectives of principles, fundamentals, operation and organization of the American Standards Association (ASA).

ENGINEERING FORMULAS AND TABLES. 350 *pages.* $2.75. *Lafax Publishers, Philadelphia* 7, *Pa.* Newly revised, pocket-size edition containing basic formulas, design data, tables for civil, mechanical and electrical engineers. Sections include mathematics, measures, materials, gages, screws, mechanics, electricity and magnetism, hydraulics, steam tables.

COMMERCIAL STANDARD CS201-55. RIGID POLYVINYL CHLORIDE PLASTIC SHEETS. 11 *pages.* 10¢. *Supt. of Documents, U. S. Government Printing Office, Washington* 25, *D. C.* Covers physical and chemical properties, methods of test for high-impact and normal-im-

pact, chemical-resistant rigid polyvinyl chloride plastic sheets suitable for fabricating equipment and structures by hot-forming and plastic welding techniques.

1952-1953 BIBLIOGRAPHIC SURVEY OF CORROSION. 382 *pages.* $12.50 (*non-members*), $10 (*members*). *National Association of Corrosion Engineers,* 1061 *M & M Bldg,. Houston 2, Texas.* Fifth of a series of NACE bibliographies on corrosion literature. Presents summaries of 3,344 corrosion and corrosion-prevention articles, books and brochures published in 1952-1953. Abstracts are arranged topically, according to NACE Abstract Filing Index —general, testing, characteristic corrosion phenomena, corrosive environments, preventive measures, materials of construction, equipment and industries. Cross references are appended to each section.

More New Books

CATALYTIC, PHOTOCHEMICAL, ELECTROLYTIC REACTIONS. Technique of Organic Chemistry. Vol. II. Edited by A. Weissberger. Interscience. $11.50.

CHEMICAL ENGINEERING KINETICS. By J. M. Smith. McGraw-Hill. $8.

CHEMISTRY AND TECHNOLOGY OF WAXES. 2nd ed. By A. H. Warth. Reinhold. $18.

CHEMISTRY OF HIGH POLYMER DEGRADATION PROCESSES. By N. Grassie. Interscience. $6.50.

EXAMINATION OF NEW ORGANIC COMPOUNDS. By W. T. Smith, Jr. and R. L. Shriner. Wiley. $3.50.

EXPERIMENTAL PHYSICAL CHEMISTRY. 5th ed. By F. Daniels, J. H. Mathews, J. W. Williams, P. Bender and R. A. Alberty. McGraw-Hill. $6.50.

INTRODUCTION TO MODERN ORGANIC ANALYSIS. By S. Siggia and H. J. Stolten. Interscience. $4.50.

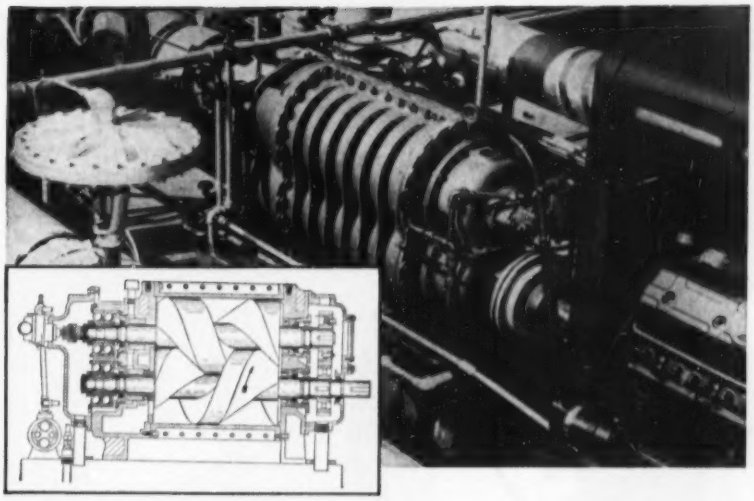
KORROSIONSTABELLEN NICHTMETALLISCHER WERKSTOFFE. By F. Ritter. Springer-Verlag. $8.35.

PETROLEUM REFINERY ENGINEER'S HANDBOOK. By J. F. Strachan. Philosophical Library. $15.

PHOTOSYNTHESIS AND RELATED PROCESSES. Vol. II, Part 2. By E. I. Rabinowitch. Interscience. $18.50.

STATISTICAL MECHANICS. By T. L. Hill. McGraw-Hill. $9.

VAPOR-LIQUID EQUILIBRIUM DATA. By J. C. Chu, S. L. Wang, S. L. Levy and R. Paul. J. W. Edwards. $9.



MODERN SPIRAXIAL® COMPRESSORS

BUILT WITH R-C *plur-ability*

Users of these latest Roots-Connersville Spiraxial Compressors tell us of their amazing efficiency and economy, at ranges of 700 cfm to 5,000 cfm, and pressures from 15 psi to 30 psi (or higher).

Then, there are these other R-C *plur-ability* advantages:

- No internal lubrication, hence oil-free air
- Direct-connected for speeds of 1750 rpm and 3550 rpm
- No water jacketing needed
- Compact—requires less space
- Minimum noise level

With many applications possible because of these advantages, we suggest you study the performance curves and other details in Bulletin SC-354. You may well find that the long-time economy of R-C Spiraxial units will justify replacing less efficient equipment.

Ask about *plur-ability* in all R-C equipment

Centrifugal and Rotary Positive Blowers, Gas Pumps and Exhausters
•
Positive Displacement Vacuum Pumps and Meters

Inert Gas Generators
•
Spiraxial® Compressors
•
Detailed bulletins available on all R-C equipment.

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A DIVISION OF DRESSER INDUSTRIES, INC.

456 Illinois Ave., Connersville, Indiana. In Canada, 629 Adelaide St. W., Toronto, Ont.

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USG SOLFRUNT®

(SOLID FRONT CONSTRUCTION)

the gauge with

BUILT-IN SAFETY!

There's safety with the new USG Solfrunt Gauge . . . behind the face is a solid metal wall! In the event of a Bourdon tube rupture, pressure is released through the large rubber blowout back. The case is of aluminum.

Like USG's Supergauge . . . with proper application . . . the Solfrunt is built to last a lifetime.

ARC-LOC MOVEMENT—Rugged beyond compare . . . broad generated gear faces, deep stainless steel bushings. Calibration adjustments from rear by merely removing blowout back.

SEGMENT—Stainless steel, with nylon-faced gear section. Nylon-to-metal bond stabilizes the nylon against expansion and contraction . . . maintains accurate pitch diameter . . . assures proper mesh with stainless steel pinion under severe temperature and moisture conditions.

LEGEND ON DIAL—gives complete description of socket, Bourdon tube, and movement material for ready identification.

MICROMETER ADJUSTABLE SELF-LOCKING POINTER—permits accurate repositioning of pointer.

Solfrunt Gauges available in 4½", 6" and 8½" sizes. For complete information on case styles, materials of construction and connections, write for Publication 1819.

UNITED STATES GAUGE

Division of American Machine and Metals, Inc.

Sellersville, Pa.

Home of the **SUPERGAUGE**

THIS MONTH'S

Firms in

NEW REPRESENTATIVES

Lewis-Shepard Products, Inc., Watertown, Mass. has appointed W. G. Smith, Portland, Ore., as exclusive sales and service representative in the Portland area.

Brown-Allen Chemicals, Inc., Staten Island, N. Y., has appointed Jesse S. Young Co. as its exclusive sales representative for its oil division's line of oils, specialties and plasticizers in the New York and Metropolitan area.

Owens-Corning Fiberglas Corp. has appointed Barrett division of Allied Chem & Dye to distribute Fiberglas roof insulation in 11 southern states.

NEW COMPANIES

Nofsinger-Long Co. has been formed to handle over-all design and construction of petroleum and chemical plants as a result of an agreement between C. W. Nofsinger Co. and Long Construction Co., both of Kansas City, Mo.

Chemoil Corp. has been formed to build a $20-million oil refinery in the New Orleans area.

Thermo Materials, Inc., has been formed in San Francisco to specialize in the development and production of precision high temperature industrial ceramics.

Skyway Automotive Products, Inc., Salt Lake City, has been formed to manufacture brake fluids, radiator sealants, antifreeze, and other automotive chemicals.

Aerojet-General Nucleonics, Walnut Creek, Calif., has been formed to develop and produce nuclear reactors.

Minnesota Rainbow Rubber Co., Minneapolis, has been formed

to produce custom-molded rubber parts from a variety of colored materials.

Vat Dye Institute, a new trade organization, has been formed by a group of the country's leading manufacturers of vat dyes for the textile industry.

Kermac Nuclear Fuels Corp. has been formed to mine and mill uranium ore in the Ambrosia Lake area of New Mexico.

Pinturas Ico Ltda. has been formed in Colombia, S.A., to manufacture paints. Owners are W. R. Grace and Glidden.

Fenwal Electronics, Framingham, Mass., has been formed to manufacture precision temperature controls and heat detectors for industrial and aviation use.

NEW FACILITIES

Archer-Daniels-Midland Co., Minneapolis, has purchased half-interest in the Applied Radiation Corp., Walnut Creek, Calif., producer of linear electron accelerators and other electronic equipment.

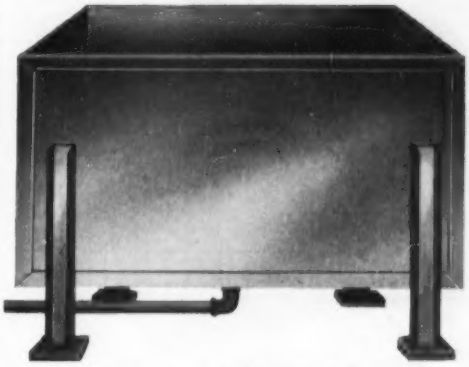
Brown Co., paper manufacturer of Berlin, N. H., plans to buy three companies in North Stratford, N. H.: Granite State Veneer, Inc., Plywood Products, Inc. and Stratford Realty Corp.

Cosden Petroleum Corp. has started up a million-gal./yr. plant in Big Spring, Tex., to produce low-viscosity polybutene. The company has set up marketing and distribution facilities for the product, tradenamed Polyvis.

Sunray Mid-Continent Oil Co. has started a new cycling plant at Northwest Branch, La. Processing 690 million cu. ft. of natural gas monthly, plant can produce 65,500 bbl.

faster, more economical emulsifying

with ultrasonics



Ultrasonics can reduce production costs and accelerate and improve many processes in the chemical industry. For example, emulsifying oils and aqueous solutions — even the difficult emulsification of mercury and water — can be accomplished simply and efficiently with ultrasound.

Gulton Industries now offers a complete line of ultrasonic generators and matching transducers that will solve your emulsification problems and, in addition, help you improve many other chemical processes including mixing, degassing, plating, and cleaning.

The GLENNITE® Ultrasonic Generator, Model U-405VF, for instance, is a variable frequency unit that operates in the range from 20KC to 2MC, has an output of 500 watts, input of 100 watts, and an impedance range of 50 to 2000 ohms. It is particularly suited for pilot plant experimentation to determine the optimum frequency level of ultrasonics for specific applications.

Ultrasonics may be the solution to many of your chemical processing problems. Why not find out more about this new field? Detailed information and engineering assistance is immediately available from our staff or the field representative in your area.

VIBRO-CERAMICS DIVISION

GULTON INDUSTRIES, INC.

Gulton Industries, Inc.

METUCHEN, NEW JERSEY

DAY REVERSE JET DUST FILTERS

HAVE EARNED INDUSTRY'S ACCEPTANCE

Introduced in 1949, the rapid sales growth of DAY "AC" dust filters measures industry's approval of this totally different dust filter. Bar graph (drawn to scale) shows how sales of DAY "AC" filters have increased during the past seven years.
1949
1950
1951
1952
1953
1954
1955

HERE'S WHY DAY Reverse Jet Dust Filters HAVE EARNED ACCEPTANCE!

Utilizing the Hersey principle of reverse air cleaning, DAY "AC" dust filters brought industry a needed, long overdue, improved dust filter. This filter has many benefits never before found in any dust filter equipment.

- NEW HIGH EFFICIENCY PERFORMANCE—This filter provides efficiencies measured as high as 99.99+%. This assures cleaner air and higher product recovery.
- NEW FILTER MEDIA—DAY *felted* filter media traps more dust than woven fabric. Felt gives higher efficiency, longer life and has same pressure drop as woven fabric.
- NEW DESIGN FEATURES—The Hersey principle of reverse jet cleaning, DAY self-adjusting blow rings, sanitary square-to-round air inlets, automatic-continuous operation, superior filter media, are just a few of the features introduced by DAY.
- NEW FILTER TUBE CLEANING—Patented self-adjusting blow rings clean the entire filter tube automatically and continuously, to give DAY filters an air handling capacity 5 times higher than ordinary filters.
- NEW LOW INSTALLATION COSTS—Unit sub-assembly saves time and money—up to 75% on filter erection costs.

Licensed by H. J. Hersey, Jr.

The DAY "AC" Reverse Jet Dust Filter is the largest selling filter of its type in the world!

Place the successful operation of your dust control system in our hands. Experienced DAY Application Engineers will survey your plant and supply you with engineered recommendations. With DAY there is no divided responsibility. Our guarantee of satisfaction is backed by 75 years of experience.

Bulletin 559 gives important facts and complete description of the DAY "AC" dust filter. Write toDAY for your copy of this informative 24-page bulletin.

75 YEARS DAY SERVING INDUSTRY SINCE 1881

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IN CANADA: P. O. Box 70N, Fort William, Ontario
Branch Plants: Buffalo, Fort Worth and Toronto, Ontario
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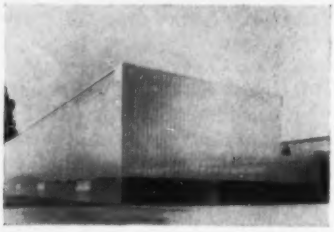
FIRMS . . .

monthly of stabilized distillate, butane, and propane.

Garfield Chemical and Mfg. Corp. is expanding production of sulfuric acid to 1,100 tons/day by constructing its fifth contact sulfuric plant at Garfield, Utah.

Monsanto Chemical Co. has completed facilities which triple capacity to produce vinyl chloride paste resin at the Springfield, Mass., plant of its plastics division.



Surface Combustion Corp., Toledo, has completed a plant addition to house its heat treat furnace and gas generator assembly department. Insulated building is made of reinforced aluminum siding with translucent fiber glass reinforced plastic skylights.

Stauffer Chemical Co. has purchased Harshaw Chemical Co.'s interest in New York-Ohio Chemical Corp. and Nyotex Chemicals.

G. D. Searle & Co., Chicago, has installed a radioactive tracer laboratory to broaden the scope of its pharmaceutical research.

Cutter Laboratories has bought Corn King Co., Cedar Rapids, manufacturer of animal feed additives.

United States Testing Co. has opened an analytical soils laboratory at its Memphis branch.

Salt Lake Refining Co., San Francisco, plans to complete a 6,000-bbl./day platinum reformer.

Western Phosphates, Inc. is spending $2 million for ex-

pansion of its plant near Garfield, Utah. Completed by the first of the year will be facilities for production of liquid-type high strength nitrogen-phosphate fertilizer.

Hooker Electro-Chemical Co. and Oldbury Electro-Chemical Co., both of Niagara Falls, have announced plans to merge.

Permatex Co. has started construction on a new office building at Huntington St., Long Island, N. Y.

American Brass Co. has completed a $2.5-million plant at Mattoon, Ill., for flexible metal hose and tubing.

Fischer & Porter Co. has opened a new sales office in Pensacola, Fla.

Parameters, Inc., New Hyde Park, N. Y., has opened a new environmental testing facility for conducting qualification tests in accordance with military specifications.

Ultra Chemical Works, Inc., Paterson, N. J., has completed a $250,000 plant addition to boost production in its organic chemical department.

Pontiac Refining Corp., has installed a second platformer, a 13,000-bbl./day unit at Corpus Christi, Tex.

Pan-Am Southern Corp. is installing a second ultra-forming unit for production of high octane gasoline at its El Dorado, Ark., refinery.

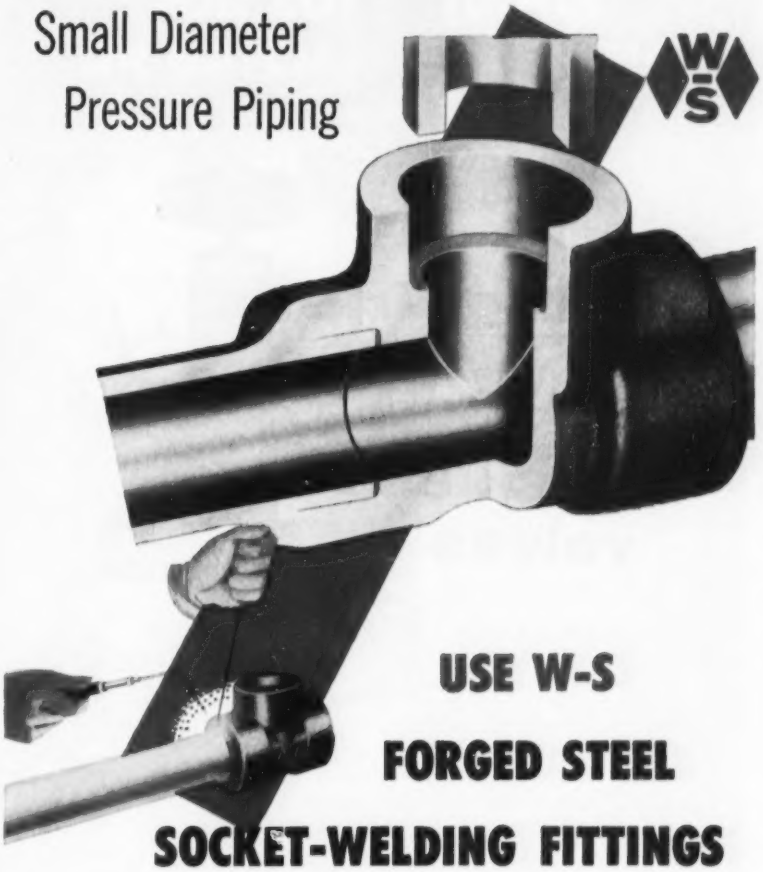
Battelle Institute, Columbus, Ohio, has established a cobalt information center to provide technical and economic information for users in the metallurgical, chemical, ceramics and nucleonics industries.

Standard Oil Co. of California will build $3-million crude handling facilities at El Segundo, Calif.

Titanium Metals Corp. of America has acquired a 15-

Here's the **EASY WAY TO WELD**

Small Diameter Pressure Piping



USE W-S FORGED STEEL SOCKET-WELDING FITTINGS

In addition to providing high strength and toughness, W-S Forged Steel Socket-Welding Fittings are also easy to install. Deep sockets support and align the pipe for welding... eliminating the need for tack welding or special fixtures. No back-up ring is needed either. The fillet-weld is completely outside the pipe. Welding icicles just can't form inside the pipe. The result is a clean, tight welded joint that will readily resist high pressures and the stresses of shock and vibration. What's more, installation costs are lower.

W-S Socket-Welding Fittings are available in sizes ⅛" to 4" for schedule 40, 80, 160 and double-extra heavy pipe in carbon steel, stainless steels and alloy steels.

For complete information on the installation and operation advantages of W-S Forged Steel Socket-Welding Fittings, send today for Bulletin A-3-56.

W-S FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

Roselle, New Jersey

a big line of SMALL packless valves

Packless valves are designed for tough applications, like critical high vacuums, corrosive or dangerous fluids and high temperatures. Our experience with these problems has helped us to design a packless valve line broad enough to suit many of these applications. As evidence may we present:

The 431 Series – a greatly improved version of the Hoke brass bellows needle valve offering extended, leak-tight service life . . . suitable for sampling systems and analysis equipment—bronze bellows, stainless steel (blunt or vee) spindle in ⅛" and ¼" pipe sizes.

The 480 Series – Globe or angle valves in brass or monel with phosphor bronze or monel bellows.

The 440 Series – for supercritical applications An all stainless bellows valve with Teflon seat—⅛" to ½" pipe sizes. (Both 480 and 440 series have replaceable bellows assemblies.)

The 411 Series – All metal monel diaphragm valves with low internal volume and excellent service life.

For those of you who have special problems, modifications of these valves are available for high temperatures and pressures. You'll find us most receptive to your inquiries.

WE'VE JUST COMPLETED A NEW PACKLESS VALVE BULLETIN THAT WE'D LIKE TO SEND TO YOU. WRITE TO

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Fluid Control Specialists

139 S. DEAN STREET, ENGLEWOOD, NEW JERSEY

FIRMS . . .

yr. lease on the Henderson, Nev., plant of Pioche Manganese Co.

Dierks Paper Co. will complete a $10-million kraft mill at Pine Bluff, Ark., by November '57.

Ashland Oil & Refining Co. has purchased R. J. Brown & Co., St. Louis chemical and solvent producer.

Hercules Powder Co. will complete two new tall oil fractionation plants at Franklin, Va., this fall expected to yield 115 million lb. of rosin and fatty acids out of the 140 million lb./yr. of raw material processed.

Tube Turns has bought $2-million worth of industrial property in Louisville, Ky., for expansion purposes.

ORRadio Industries, Inc., Opelika, Ala., will build a $300,000 plant for the manufacture of magnetic instrumentation tape for the geo-physical field.

Cutter Laboratories has acquired Geo. A. Coleman Co., owners of Pacific Plastic Products of San Francisco.

Glidden Co. will expand its new titanium dioxide plant in Baltimore to quadruple its capacity by 1957.

National Lead Co. has acquired a substantial interest in Baritina de Venezuela, distributor of oil well drilling materials which plans to build production facilities.

Lamex Chemical Corp., Leominster, Mass., has acquired a $500,000 building in Manchester, N. H.

Southwest Research Institute, San Antonio, Tex., will build a laboratory for the U.S. Army Ordnance Corps for research on fuels and lubricants of the future.

Atlas Consolidated Mining and Development Corp., Cebu, Philippines, will build a $3.5-

million fertilizer and acid plant which will process about 200 tons/day of pyrites.

Allegheny Ludlum Steel Corp. will purchase Paul R. Repath, Inc., Los Angeles producer of electrical steel lamination, metal stampings.

Organic Corp. of America has completed a new plant in McKeesport, Pa., housing a process which takes a city's entire accumulation of raw garbage, trash and waste and within 14 to 21 days transforms it into an organic fertilizer.

Owens-Corning Fiberglas Corp. will complete expansion of its textile fiber plant at Anderson, S. C., by mid-1957. Output will be increased by 50%.

Premier Oil Refining Co. will spend $1.25 million in modernizing its 4,500 bbl./day refinery in Longview, Tex.

Bay Petroleum Corp. has completed construction at Houston to increase gasoline quality to 89, 95 and 98.5 octanes.

Shell Chemical Corp. is expanding its customer service laboratory at Union, N. J.

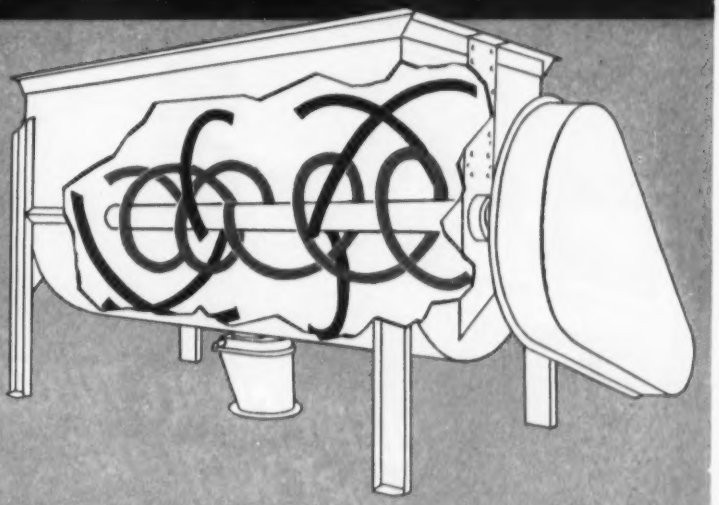
Sprout, Waldron & Co. has completed a new office building at its Muncy, Pa., headquarters.

H. K. Porter Co. has acquired Electric Service Mfg. Co., Philadelphia.

Stanat Mfg. Co is building a new plant for making metal processing equipment at Westbury, N. Y.

Oak Ridge National Laboratory has completed a 2000-curie

FOR CONTINUOUS
OR BATCH OPERATIONS



Readco counterflow action

assures rapid, thorough mixing or blending of pulverized or granular, wet or dry materials.

Heavy-duty construction stands up under long runs and adverse processing conditions with a minimum of costly downtime.

Readco Spiral Ribbon Mixers can be supplied for atmospheric, elevated pressure or vacuum operation . . . with or without temperature controlling jackets. Working capacities up to 500 cubic feet.

BAKERY-CHEMICAL DIVISION
York, Pennsylvania

READ STANDARD
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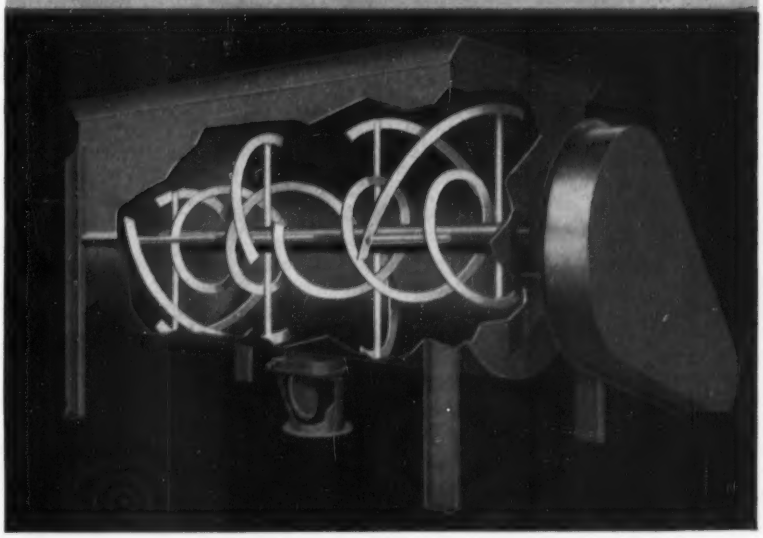
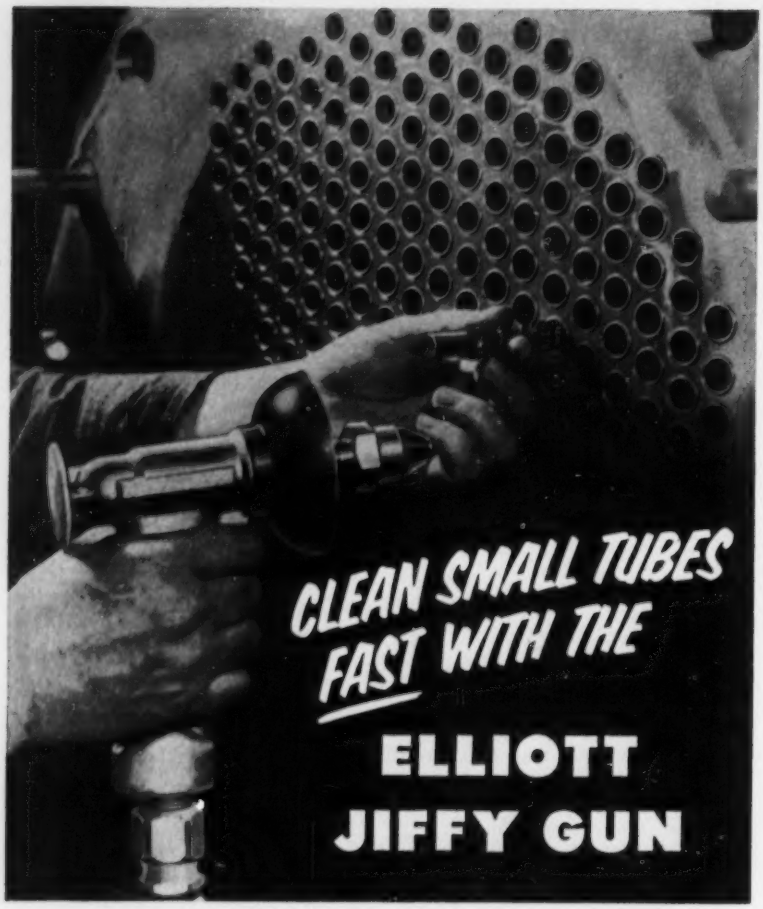
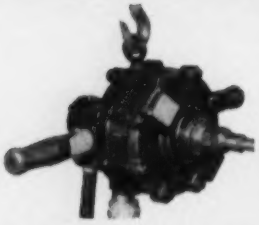






SUSPENSION CLEANER
For hard scale in straight tubes—direct drive cleaner using shaft and drill heads. Air or electric motor driven. Motor supported by overhead pipe.

JIFFY GUN BOOSTER
Combines water and air pressure for extra power and speed, recommended where water pressure is low, or scale deposit is heavy.

600 SERIES CLEANERS
For small curved or straight tubes. Air or steam driven motors. Can be equipped with brushes or scraper head.

JIFFY GUN BRUSHES AND PLUGS
Spiral-wound nylon brushes with rubber bumpers are favorites for small tube cleaning. Rubber plugs can also be used. Brushes and plugs available in required sizes.

For descriptive bulletins, write Elliott Company, Lagonda Division, Springfield, Ohio.

V6-3A **ELLIOTT Company**

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

FIRMS . . .

cesium-137 gamma ray source. It is the laboratory's second large cesium source.

Westinghouse Electric Corp. plans to build a multimillion-dollar distribution transformer plant in Athens, Ga.

Rogosin Industries Ltd., a newly organized company sponsored by American industrialists, will build a $20-million rayon yarn and tow plant in Israel.

Ashland Oil & Refining Co., Ashland, Ky., has acquired R. J. Brown & Co. of St. Louis, a producer of solvents and chemicals.

B. T. Babbitt, Inc., has acquired two companies in the aerosol packaging field: Connecticut Chemical Research Corp. and its subsidiary, Bostwick Laboratories, Inc., both of Bridgeport, Conn.

Allied Chemical & Dye Corp.'s Barrett Div. has started operations at its new insulation board plant at Sunbury, Pa.

Imperial Chemical Industries plans to complete a titanium fabrication mill in Waunarlwydd, South Wales by the end of next year.

Bristol Co., Waterbury, Conn., has opened a new western sales office in Denver.

Maruzen Oil plans to ask Japanese government soon to approve building of 5,000 bbl./day refinery on Menam River at Bangkok.

Standard Oil of Ohio plans to build a $3.7-million alkylation unit and $2.4-million research center in the Cleveland area.

H-B Instrument Co., Philadelphia, has purchased the Tagliabue Mfg. Co. from Weston Electrical Instrument Corp.

Westinghouse Electric Corp. will expand its activities at Large, Pa., which it conducts for the Atomic Energy Commission.

Hercules Powder Co. is considering the manufacture of high strength nitric acid at its Bacchus, Utah, dynamite works. Now undergoing a $2.2-million expansion, the facility will use increased amounts of nitric in making nitroglycerin for mixing with ammonium nitrate in dynamite manufacture.

Gladding, McBean & Co. has discovered large new deposits of high-value clay in Bedford Canyon near Corona, Calif. It plans a $7-million, 12,000-ton/mo. plant adjacent to the deposit for the manufacture of vitrified clay pipe.

California Spray Chemical has completed a 150-ton/day ammonium sulfate crystallizing unit, part of its multimillion-dollar fertilizer plant at Richmond, Calif.

Pure Oil Co. plans a new catalytic reforming unit at its Lemon, Ill., refinery. Unit will include a 12,000-bbl./day catalytic reformer and a 17,000 bbl./day feed preparation unit.

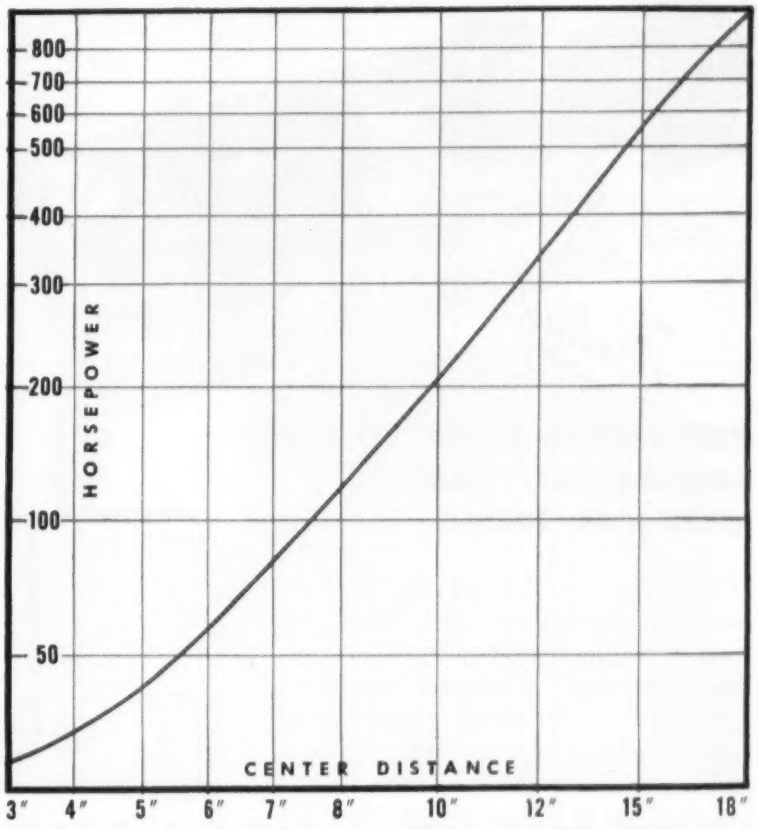
Texas Oil Co. has land under option in Anacortes, Wash., for possible construction of a Pacific Northwest refinery.

Tube Turns of Canada Ltd. has bought a new plant at Ridgetown, Ont.

Delta Refining Co., Memphis, recently sold to the Southland Co., will undergo a $1-million modernization program to permit production of 100-plus octane gasoline.

Burkart-Schier Chemical Co. is building a new laboratory at Chattanooga to handle research in connection with a contract recently signed with American Viscose Co. B-S will manufacture certain Avisco textile chemicals to specification and act as sole selling agent in 17 states.

Companhia Industrias Quimicas Resende has been formed by three Swiss companies—Sandoz, Ciba and Geigy—to



WE LEFT COMPETITIVE RATINGS OUT OF THE CHART PURPOSELY..

. . . because we think the load-carrying capacity of Cone-Drive speed reducers is pretty impressive all by itself. Then, we've also got a lot of friends in the worm gear speed reducer business. And they make pretty fair reducers themselves.

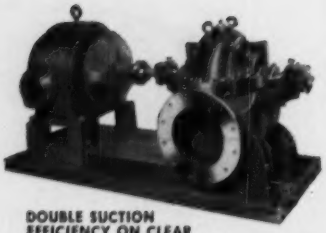
Two things are responsible for the high capacity of Cone-Drive speed reducers. First, we use extra-heavy gears mounted on oversize taper roller bearings in reinforced, heavy housings. Extra "beef" alone accounts for part of our capacity.

Even more important, however, is the Cone-Drive double-enveloping worm gear design. Here, we literally wrap worm and gear around each other to put ⅛ of all teeth in continuous full-depth contact. This results in spreading tooth contact over a greater area, reducing pressure on individual teeth, increasing load capacity and life of the gearing.

Ask for Bulletin 600C without obligation.

CONE-DRIVE GEARS
DOUBLE ENVELOPING GEAR SETS & SPEED REDUCERS
Durarion, Michigan Tool Company
7171 E. McNichols Road • Detroit 12, Michigan

CLOSE-COUPLED SPACE SAVERS
Husky, efficient. Shaft permanently aligned. For clear water. Write for Bulletin 975.



DOUBLE SUCTION EFFICIENCY ON CLEAR WATER, 10 to 14,000 gpm. "Buffalo" Type SL Pumps. Write for Bulletin 955-Q.

"Buffalo"

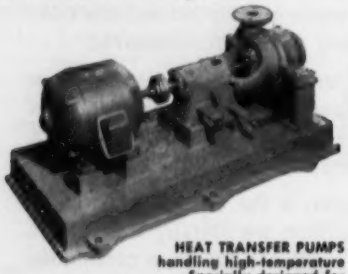
THE PUMPS BUILT TO LIVE LONGER ON YOUR CHEMICAL JOBS!

"Buffalo" has been building the specialized pumps required by the chemical industries for many years — building them for the long run. That takes special engineering and rugged construction — heavy shafts with ball bearing support — husky impellers — heavy casings with plenty of accessibility — other features you don't find in ordinary pumps. These "Q" Factor* features cost more to build into pumps — yet by the same token, "Buffalo" Pumps have always proven far more economical to operate, in terms of longer life — lower maintenance costs — less driving power. For your next job, make it the pumps that will live longer to save you money — have your contractor write "Buffalo" into plans.

SUMP PUMPS
No stuffing box maintenance, no suction lift. "Package" installation. Write for Bulletin 963-F.

CHEMICAL and PAPER STOCK PUMPS. Diagonally split-shell. Non-clogging. Available rubber-lined. Write for Bulletin 953 and check this broad line.

CHEMICAL SERVICE PUMPS in alloys to handle your liquid. Also lead-acid and rubber-lined. Write for details.



HEAT TRANSFER PUMPS handling high-temperature liquids in vapor phase heat transfer. Specially designed for transfer. Write today for details.

*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

"Buffalo" PUMPS

BUFFALO PUMPS
DIVISION OF BUFFALO FORGE CO.
501 Broadway Buffalo, N. Y.
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

FIRMS . . .

establish a plant in Rio de Janeiro, Brazil, to produce 300 ton/yr. of aniline and 150 tons/yr. of basic chemicals for the pharmaceutical and tanning industries.

Herbert Chemical Co., Cincinnati, has bought the Chemical Corp. of America's caustic soda operation in that city.

Iowa State College, Ames, will be the site of the government's proposed $18-million animal disease laboratory.

Grain Processing Corp., Muscatine, Iowa, has started construction of a new building for chemical, biochemical and nutritional research.

Mallory-Schwarzkopf Metals, Inc., Huntsville, Ala., will complete a plant to produce and fabricate molybdenum, tungsten and tantalum early in 1957.

Venezuelan government plans to spend $1 million next year on two new plants capable of producing 120 tons of ammonia.

American Enka has scheduled completion of its $21-million rayon staple fiber unit near Morristown, Tenn., for late this year.

NEW LOCATIONS

Isotope Products Inc. has moved its main office and plant to 1711 Elmwood Ave., Buffalo, N. Y.

Continental Turpentine & Rosin Corp. will move its plant and operations to Shamrock, Fla., about June '57.

Baird Chemical Corp. has moved to 10 West 33rd St., New York.

National Bureau of Standards has bought a tract of land near Gaithersburg, Md., for relocation of its Washington, D. C., laboratories.

Geigy Chemical Corp. has moved its pharmaceuticals division

to Saw Mill River Rd., Ardsley, N. Y.

Carbide and Carbon Chemicals Co. has moved its New York district sales office to 100 East 42nd St., New York.

Standard Brands Inc. has moved its headquarters to the company's building on Madison Ave. at 59th St., New York.

Keithley Instruments, Inc., has moved plant and offices to 12415 Euclid Ave., Cleveland.

Wedgeplug Valve Co. has moved its entire operation to 4000 Tenth Ave. North, Birmingham, Ala.

NEW NAMES

Vulcan Copper & Supply Co., Cincinnati, has changed its name to Vulcan-Cincinnati, Inc.

Merck & Co. has changed the name of its division for the manufacture and marketing of pharmaceuticals and biologicals to Merck Sharp & Dohme Division.

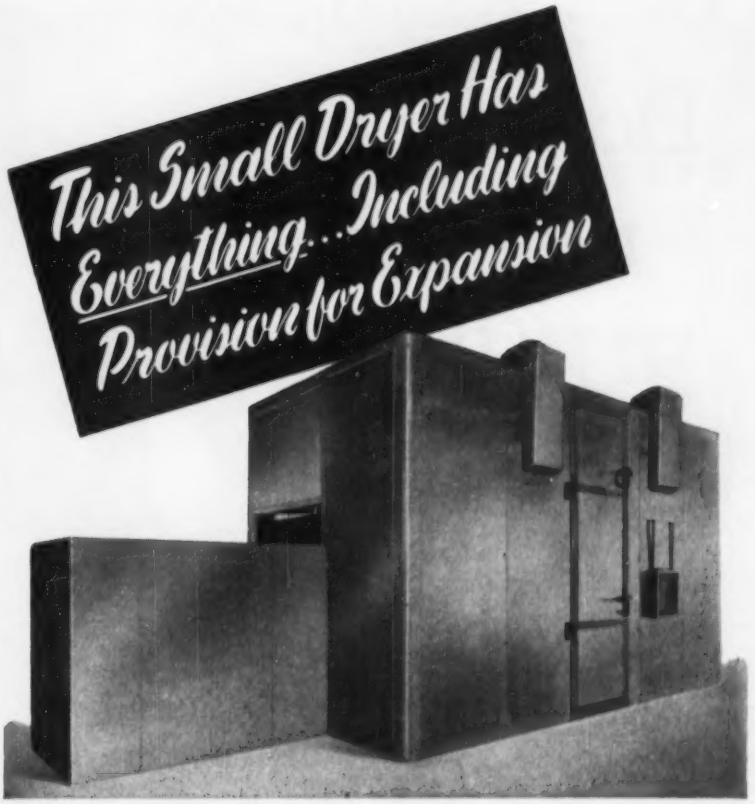
Gulton Mfg. Co., Metuchen, N. J., manufacturer of electronic equipment and systems, has changed its name to Gulton Industries, Inc., as a result of a merger with Thermistor Corp. of America and Vibro-Ceramics Corp.

NEW LINES

New York Air Brake Co. can now supply a line of high vacuum systems and equipment as a result of its acquisition of Optical Film Engineering Co., Philadelphia.

Thermal Research & Engineering Corp., Conshohocken, Pa., has been granted exclusive rights to manufacture and sell high intensity combustion devices developed and patented by Lummus Co.

Ferro Corp., Cleveland, has acquired sales and manufacturing rights for Curran conveyor type spray pickling machines from B. F. Goodrich.



"NATIONAL" APRON CONVEYOR DRYER

While this comparatively small Apron Conveyor Dryer was installed to immediately provide pilot plant production, it is readily adaptable to expansion to meet future large-scale production requirements. It incorporates all the features available in the largest "National" Dryers of this type, including the following:

The most efficient air control devices, to assure absolute uniformity of air distribution and condition through the material.

Wide flexibility in air delivery by use of adjustable pitch fans.

Adjustable sealing of air to eliminate leakage and dust carry-over to chain and other parts of equipment.

Newest heavy-duty trussed-type apron hinges.

Latest devices for chain alignment control and lubrication.

Send for Folder Describing "National" Single and Multiple Apron Conveyor Dryers and Related Equipment

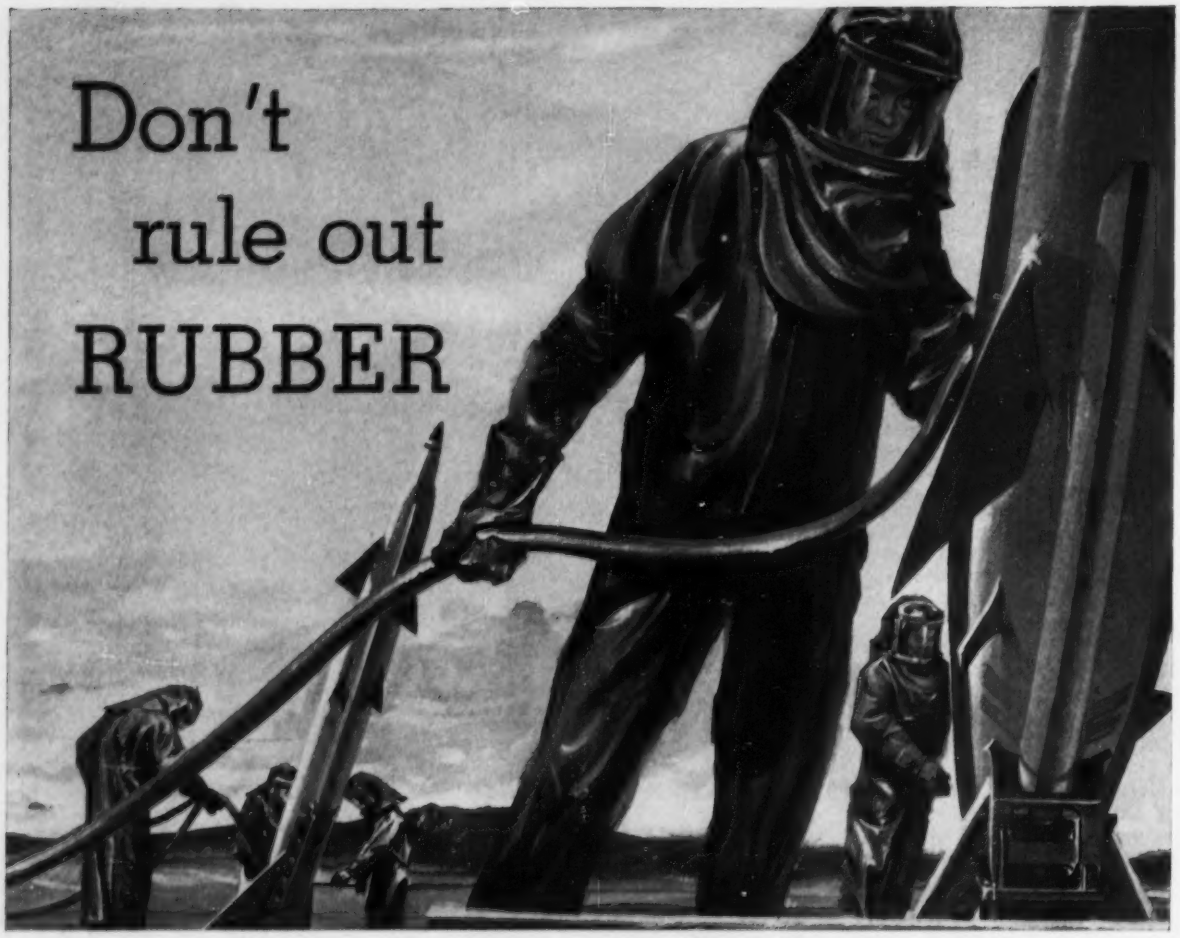
NATIONAL

The NATIONAL DRYING MACHINERY Co.

LEHIGH AVE. and HANCOCK ST., PHILADELPHIA 33, PA.

New England Agent: JONES & HUNT, INC., Gloucester, Mass.

Cable Address: "NADRYMA"—W. U. Code



Transfer Hose of KEL-F Elastomer handles red fuming nitric acid over long periods of time without deteriorating. **Protective Clothing** of elastomer-coated fabric shields workers from corrosive materials.

KEL-F® Fluorocarbon Elastomers are doing jobs that rubber never did before!

Rubber is perhaps the most useful and versatile non-metallic material used by industry today. Its resilience and resistance to abrasion and breakdown make it an important tool in industrial techniques and plant equipment.

Yet in many applications—where the mechanical properties of rubber are vitally needed—extremely high-temperature and corrosive operating conditions rule out its use.

The development of KEL-F Fluorocarbon Elastomer fills a long felt need. Here is a high strength rubber that can operate effectively under conditions that swell, stretch and melt ordinary rubber.

Today, KEL-F Elastomer can be considered for those jobs once thought "impossible" for rubber. Just check its outstanding properties:

- Extreme resistance to acids, ozone, and other oxidants
- Thermal stability to 400°F.
- High resistance to solvents, fuels and lubricants
- Low moisture absorption
- Good dielectric properties
- Non-flammability

KEL-F Elastomers have convincingly demonstrated their value in a variety of industrial roles: As *sealants* for corrosive liquids, abrasion and corrosion resistant *pump impellers* . . . heat and chemical resistant *hose, tubing, diaphragms, gaskets . . . transmission, brake* and *aircraft seals* . . . corrosion and flame resistant *protective clothing* . . . electrical and shock *insulation.*

This new elastomer is a result of Kellogg's comprehensive research in fluorocarbon chemistry. Its performance characteristics are well established in the chemical, electrical and equipment fields. If your work involves rubber at any point, then KEL-F Elastomer warrants investigation.

Our Technical Staff is prepared to work with you in adapting KEL-F Elastomer to your needs. For further information, write: The M. W. Kellogg Company, Chemical Manufacturing Division, P. O. Box 469, Jersey City 3, N. J.

THE M. W. KELLOGG COMPANY

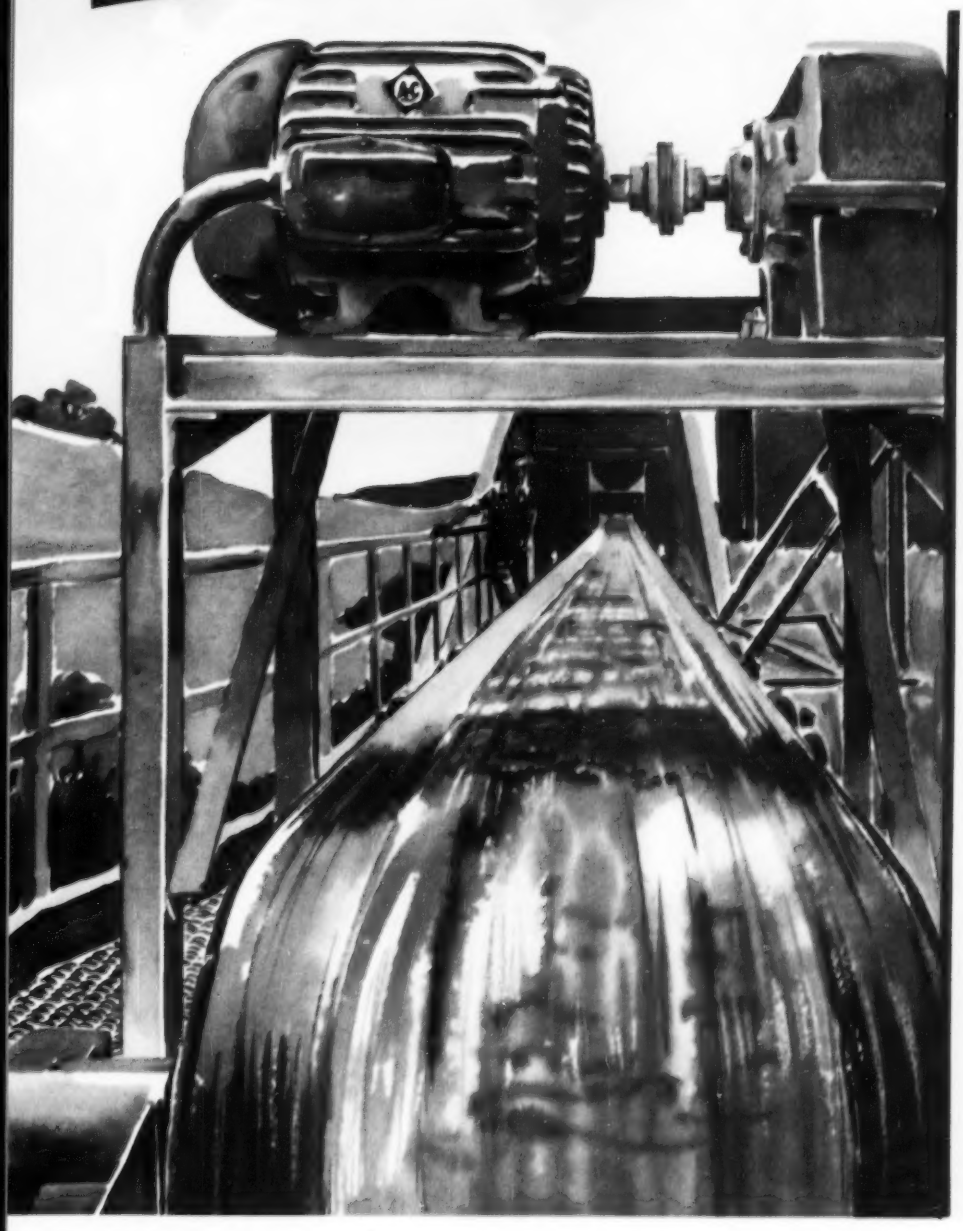
Subsidiary of Pullman Incorporated

® KEL-F is the registered trademark of The M. W. Kellogg Company for its fluorocarbon products.

There's MORE

'Round-the-Calendar Operation

with Allis-Chalmers MOTORS



MORE IRON AND COPPER provide double protection against costly breakdowns. Liberal use of cast iron protects against frame distortion, and greater amount of copper increases electrical life.

MORE COOLING SURFACE of Allis-Chalmers deep-rib motors makes insulation burnouts highly improbable under normal conditions. There are no external enclosed air passages to become clogged.

A NATIONAL NETWORK of Allis-Chalmers Motor Distributors is on the job day and night... ready to provide the fast service needed to keep your plant operating 'round-the-calendar.

As a new machinery component or as replacement, specify Allis-Chalmers motors. To find out more, contact your nearby Allis-Chalmers district office, your A-C distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-4906

You get **MORE** when it's Built by Allis-Chalmers

...more convenience... productive floor space ...safety!

ALLIS-CHALMERS
Type H Starters
FOR 2300 TO 5000 VOLT MOTORS

Centralized Control for an entire plant or department

Time-saving, cost-cutting convenience in planning, buying, installation, and operation are all yours with Allis-Chalmers centralized high voltage control. In addition, the factory-assembled lineup, installed in an out-of-the-way location, releases critical floor space for profitable production. From the safety standpoint, the control operates in cleaner atmosphere and can be isolated from unauthorized personnel when located in a separate control room or area.

Low-Cost Installation

Control is factory-assembled and bussed —conduit layout simplified. Lineup requires only one incoming feeder.

Simplified Expansion

Expanding lineup is simply a matter of adding a starter and connecting the bus. Each starter unit is self-contained.

Attractive Appearance

Uniformity of cubicles presents modern, streamlined appearance. Concentrating control in one lineup eliminates cluttered look.

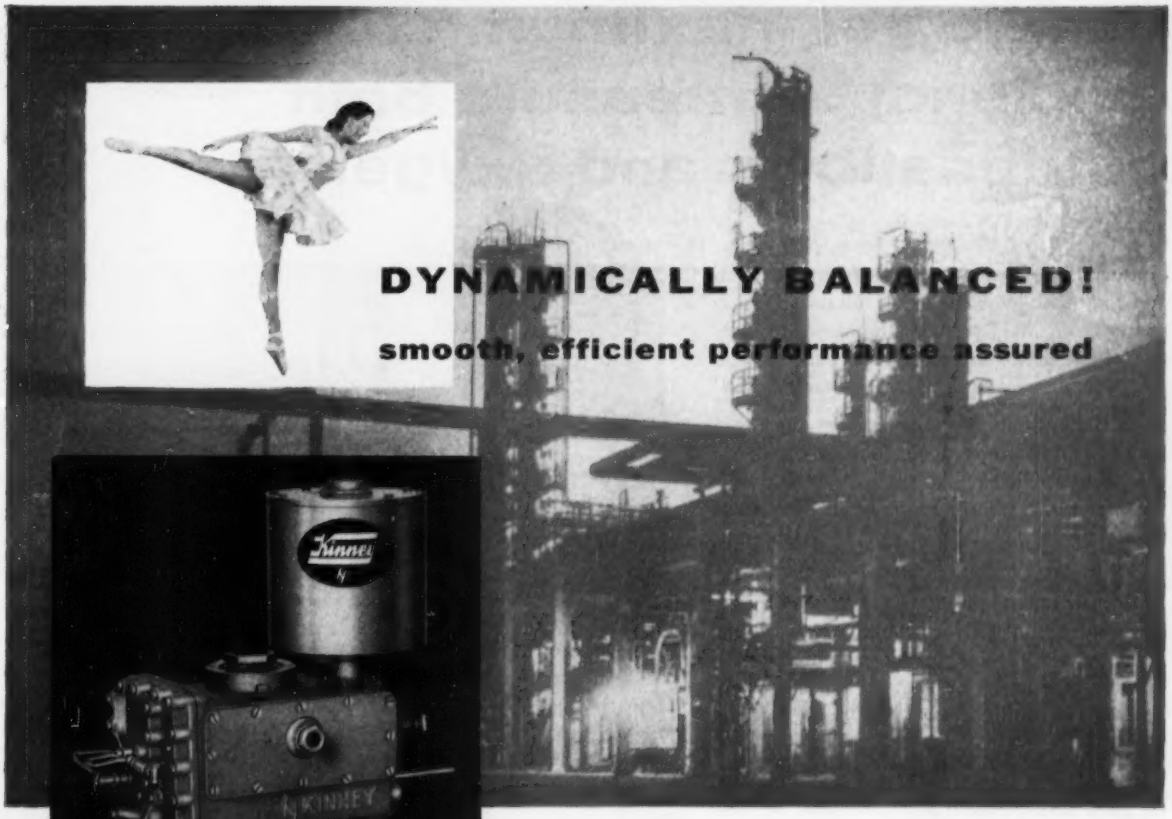
One Company Responsibility

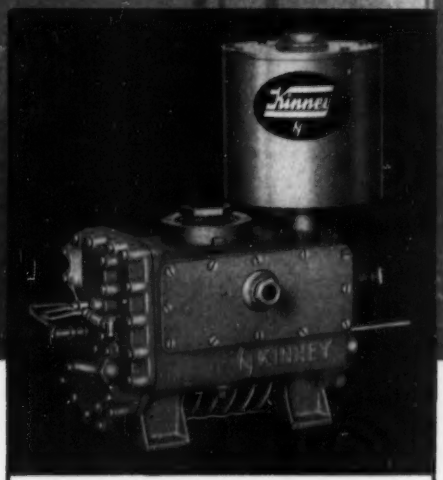
Responsibility for assembling proper devices and for control performance rests with Allis-Chalmers.

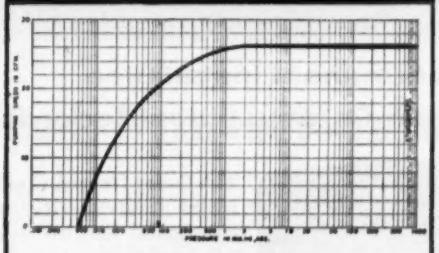
For complete information, see your A-C representative or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-4978







SPECIFICATION DATA
Model KD-30 Single Stage-Duplex
Design High Vacuum Pump

Ultimate Pressure (McLeod Gauge)	10 Microns
Free Air Displacement	30.4 CFM
Free Air Displacement	14.4 Liters/sec.
RPM	525
Motor H.P.	1½
Motor RPM	1800
Oil Capacity	2½ qts.
Cooling	Air
Shaft Diameter	¾"
Inlet Connection	1½" screwed
Outlet Connection	1¼" screwed
Valve Type	Poppet
Separator Tank	Kinney Swirl
Net Weight, Complete Unit	370 lbs.

Overall Dimensions, Complete Unit with Motor: Length — 28¾"; Width — 20½"; Height — 19⅞"

BY NEW Kinney®

Model KD-30 High Vacuum Pump!

Here is functionally vibration-free pump performance to provide the vital vacuum needed in research, pilot plant, or production applications throughout the chemical industry.

- **For portable installations**
- **For systems requiring a minimum vibration tolerance factor**
- **For increased wear-life of pump components**
- **For other design features** (Kinney Swirl Separator Tank, Gas Ballasting, etc.) found only on Kinney pumps, check the Specification Data and Pumping Speed Curve and see why this compact, single-stage, duplex design high vacuum pump is a worthy addition to the Kinney vacuum pump line, the world's largest.

For superior vacuum equipment, contact the Vacuum Equipment Division of The New York Air Brake Company at address below.

Our engineers will gladly send recommendations on your particular vacuum equipment needs. Request additional data today or contact one of our competently staffed district offices . . . in Baltimore, Charleston, W. Va., Charlotte, N. C., Chicago (La Grange), Cleveland, Detroit, Houston, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis . . . or The International Sales Office, 90 West St., New York 6, N. Y.

WRITE TODAY — — — — — — — — — —

Name ..... *Title* .....

Company .....

Street .....

City ..... *State* .....

KINNEY MFG. DIVISION
THE NEW YORK AIR BRAKE COMPANY
3551 WASHINGTON STREET • BOSTON 30 • MASS.
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N.Y.

• Please send complete data describing the new Model KD-30 high vacuum pump.

How to get maximum combustion efficiency . . . measure <u>both</u> combustibles and oxygen

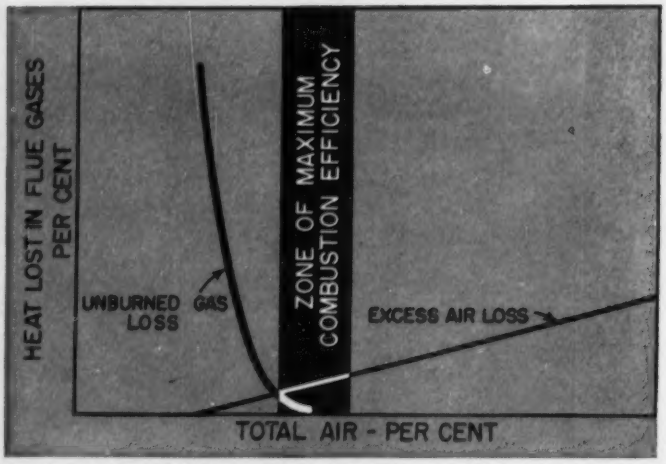
Simultaneous measurement of both oxygen and combustibles is needed to obtain optimum combustion. No instrument that measures only one of these two interdependable factors can give you the full information necessary.

Now, Bailey offers two units, each giving a continuous and simultaneous double check on combustion efficiency: a permanent analyzer-recorder which records both factors on a single chart; and a new light weight, portable unit which indicates both factors.

Both instruments measure: (1) excess air—regardless of the fuel or combinations of fuel being burned, (2) mixing efficiency of your fuel burning equipment by showing per cent combustibles in the flue gas.

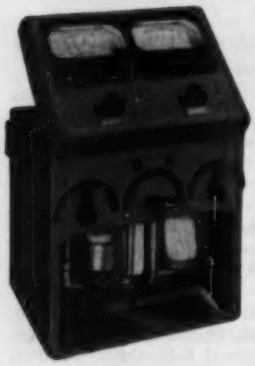
Both units are designed to increase efficiency in the furnace operations of the steel industry, on glass tanks, cement and lime kilns, ceramic and refractory kilns, steam boilers and also on direct and indirect-fired furnaces in the metal processing industries.

To prevent your money from becoming waste gas, look into these two efficiency provers. A Bailey engineer will be glad to give you details or write us for product specifications.


HEAT LOST IN FLUE GASES PER CENT
UNBURNED GAS LOSS
ZONE OF MAXIMUM COMBUSTION EFFICIENCY
EXCESS AIR LOSS
TOTAL AIR - PER CENT

Maximum Combustion Efficiency is secured by keeping the sum of Excess Air Loss and Unburned Gas Loss to a minimum. To do so by the direct method simply measure both oxygen and combustibles in flue gas.

For portable use—
HEAT PROVER Analyzer



The famous Cities Service HEAT PROVER analyzer is now Bailey built and sold. Weighing only 25 pounds, it is a self-contained automatic analyzer including a sampling tip and hose plus a thermocouple for temperature measurement.

Instrument dials are dual range for greater accuracy and sensitivity.

For permanent installation
Oxygen-Combustibles Recorder

The Bailey Oxygen-Combustibles Analyzer-Recorder coordinates both records on one chart. These records enable the operator to keep fuel burning equipment performing continuously in the zone of maximum combustion efficiency. Excess air may be reduced to the point where combustibles begin to show.

G 40-1

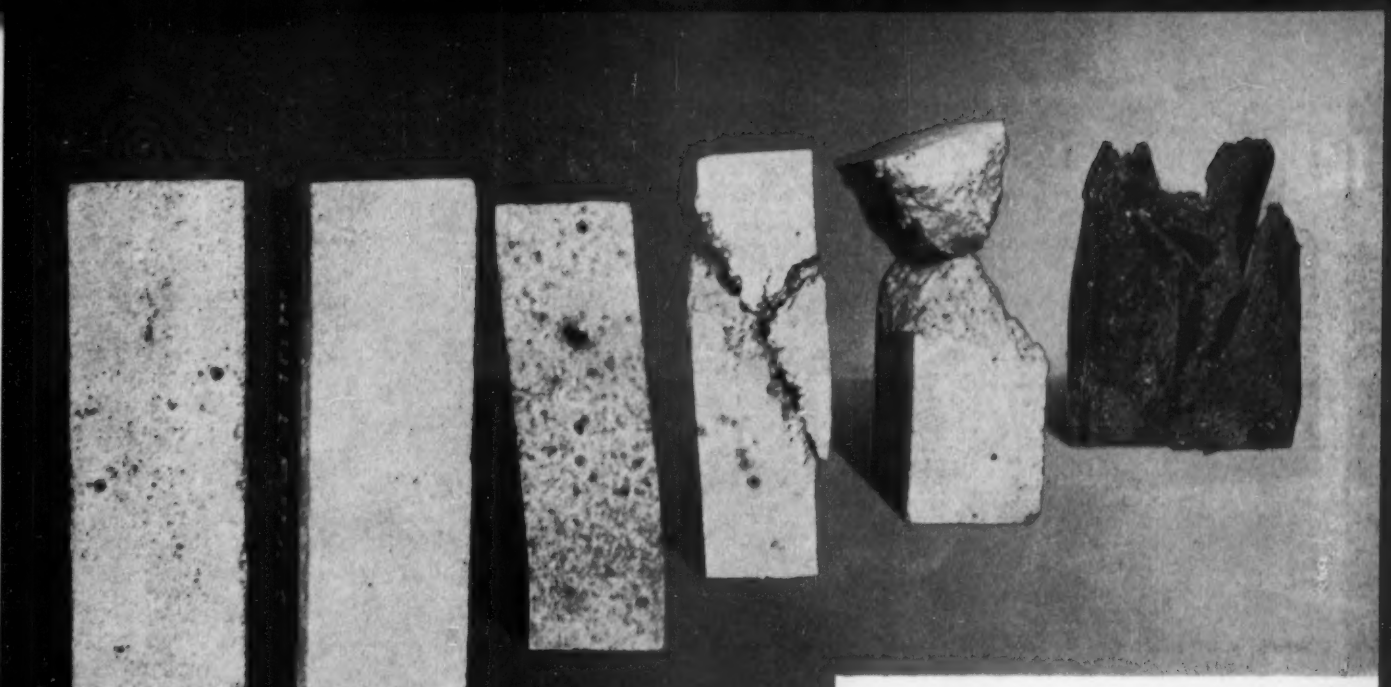
Instruments and controls for power and process

BAILEY METER COMPANY

1054 IVANHOE ROAD • CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal

BAILEY METERS



Comparison of hot strength at 1720° C and 25 psi shows CARBOFRAX® silicon carbide brick undeformed on extreme left, MULLFRAX® brick with only 1.4% contraction, ordinary refractories in various stages of deformation. The one on extreme right failed at 1650° C.

fifth in a series . . .

HOT STRENGTH

Unusual Properties of Refractory Materials

Hot Strength—When load is applied to a refractory its ability to resist heat is lessened. Increasing either load or temperature, or both, often causes the refractory to fail.

As these factors are combined in most installations — large and small — hot strength of a refractory takes on new value.

The effect of temperature in combination with load is shown by specimens pictured above. Further tests provided these data: In a test under 50 psi, a MULLFRAX® electric furnace mullite brick showed no linear contraction when held at 1500°C for 100 hours. Ordinary brick contracted an average of 7.58% at 1500°C but that at only 35 psi. In another typical case complete failure (15% contraction) was experienced with a commonly-used refractory at 1350°C and a load of 25 psi.

These differences in hot strength prove this: Where refractories fail under load and temperature, Carborundum refractories have the *extra* resistance needed to avoid slumping and, thereby, to effect less downtime, lowered maintenance costs and greater output.

Hot strength may work in another way, too. It permits use of thinner section refractories, thus reducing overall load. More insulation may be used to lower heat losses.

Carborundum's magazine "Refractories" pinpoints many practical applications for these unusual products. The next issue carries a feature article on "hot strength". Send for your copy today.

CARBORUNDUM

Registered Trade Mark

VALUABLE INFORMATION FOR USERS OF:

REFRACTORIES • CASTABLE CEMENTS • POROUS PLATES AND TUBES

CATALYST SUPPORTS • OXIDE, BORIDE, NITRIDE AND CARBIDE

HIGH-TEMPERATURE MATERIALS • CERAMIC FIBER

all in the new magazine "Refractories"

MAIL THIS COUPON TODAY

Dept. H106, Refractories Division
The Carborundum Company, Perth Amboy, N. J.

Please send me the forthcoming issue of "Refractories".

Name_____ Title_____

Company_____

Street_____

City_____ Zone____ State_____

Come to Crouse-Hinds

for Complete Protection against

Electrically-Ignited Explosions...

CONDULET® Explosion-Proof Electrical Equipment

for areas defined by the National Electrical Code as hazardous.

Rigid Conduit Fittings
Junction Boxes
Lighting Fixtures (Fluorescent & Incandescent)
Pendent Fixture Hangers
Motor Starters and Circuit Breakers
Switches
Plugs and Receptacles
Process Control Boards and Systems
Communication Systems
Instrument Enclosures
Panelboards
Mercury Switches
Signals, Alarms
Push Button Stations
Pilot Lights
Ventilating Breathers and Drains
Seals
Flexible Couplings
Unions

A NATIONWIDE DISTRIBUTION exclusively through ELECTRICAL DISTRIBUTORS

No chain of explosion-proof electrical devices is stronger than its weakest link.

Crouse-Hinds – and only Crouse-Hinds – can provide positive protection *wherever* the merest spark can possibly occur in explosive atmospheres . . . from size 5 motor starters to sound-powered telephones. There are over 15,000 conventional and explosion-proof products in the Condulet line! They are available through your Crouse-Hinds distributor.

For further assistance on your explosion-proofing problem, just call the nearest Crouse-Hinds office listed below. Our field engineers are *electrical* engineers, fully qualified to make specific recommendations for your plant.

CROUSE-HINDS COMPANY

SYRACUSE 1, N. Y.

CONDULETS • FLOODLIGHTS • TRAFFIC SIGNALS • AIRPORT LIGHTING

Another Industrial Leader...

Storage Building for J. I. Case Co., Racine, Wisconsin

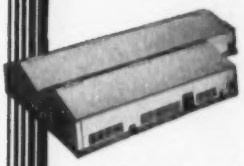
J. I. CASE CO.

continues to build with

LURIA Buildings

Tractor Development and Testing Building for J. I. Case Co., Racine, Wisconsin

Warehouse and Loading Dock for J. I. Case Co., Bettendorf, Iowa

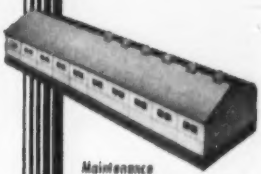


Tool & Pattern Shop for J. I. Case Co., Anniston, Alabama

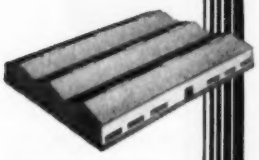
Only LURIA offers you the SPEED and ECONOMY of STANDARDIZATION... plus all the ADAPTABILITY and DURABILITY of CUSTOM-DESIGNED UNITS

Manufacturing Building for J. I. Case Co., Anniston, Alabama

For J. I. Case, famed manufacturer of farm machinery, a total of 19 Luria structural steel buildings! And Luria's re-order record with other industrial leaders is equally impressive... because Luria Buildings deliver such impressive *performance*. Each structure surpasses the most stringent building codes. Each represents substantial savings. Each is adaptable to individual requirements. These are the reasons why Luria Standardized Buildings can meet the needs of *your* expansion program. *Discuss it with your Luria representative.*



Maintenance Building for J. I. Case Co., Rockford, Illinois



Branch Showrooms and Warehouse for J. I. Case Co., Houston, Texas

LURIA ENGINEERING Company

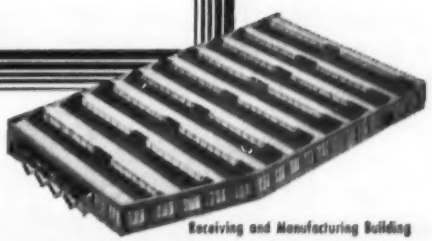
511 FIFTH AVENUE, NEW YORK 17, N. Y.

District Offices: ATLANTA • PHILADELPHIA • BOSTON
CHICAGO • WASHINGTON, D.C. • *Plant:* BETHLEHEM, PA.

Platform Shed for J. I. Case Co., Burlington, Iowa

Manufacturing Building for J. I. Case Co., Stockton, California

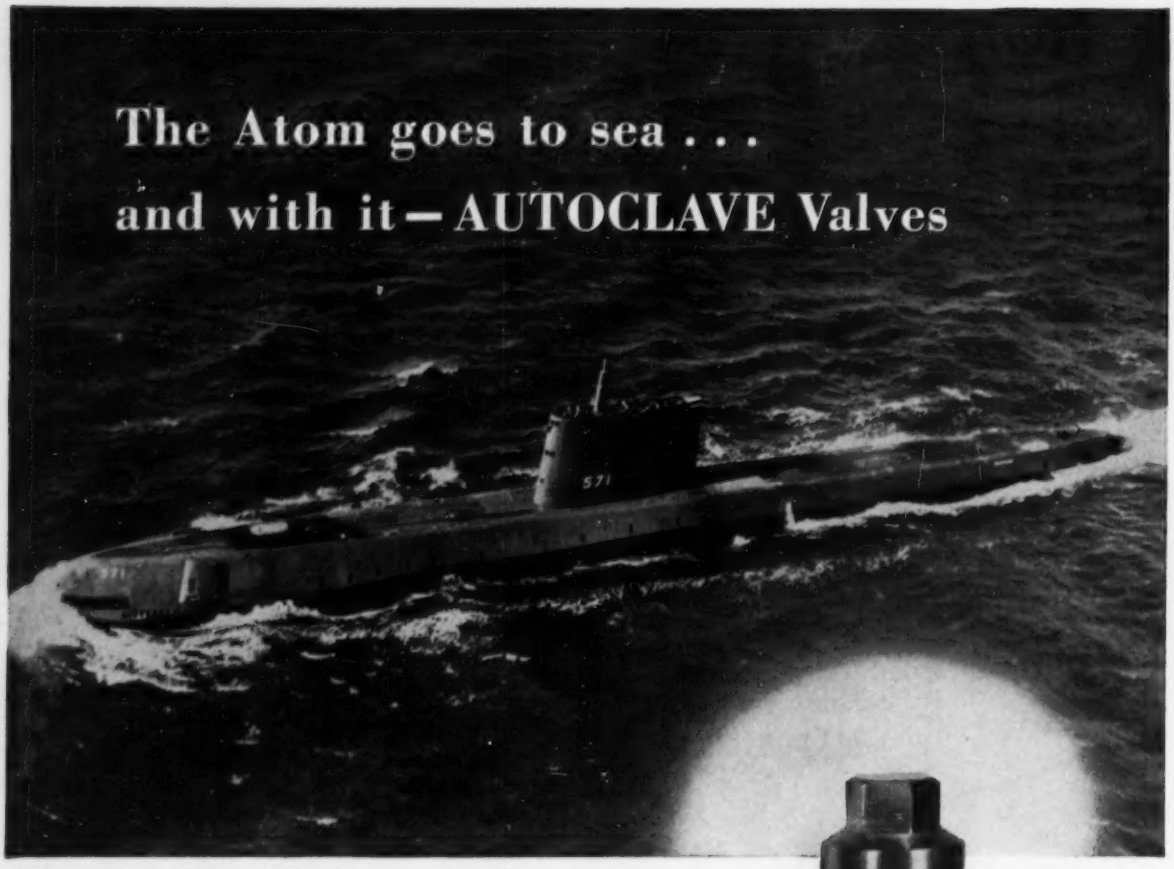
Storage Building for J. I. Case Co., Racine, Wisconsin

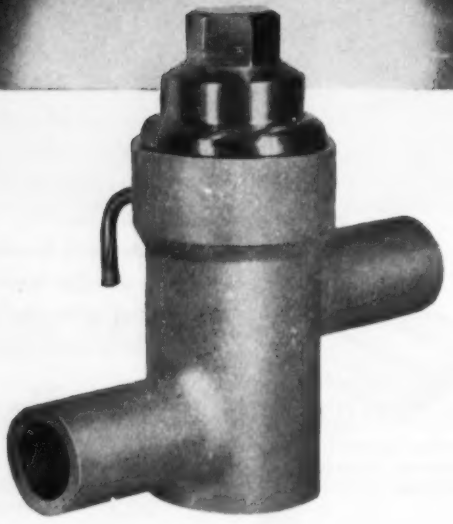


Receiving and Manufacturing Building for J. I. Case Co., Racine, Wisconsin

LURIA Customers are REPEAT Customers

The Atom goes to sea . . .
and with it—AUTOCLAVE Valves



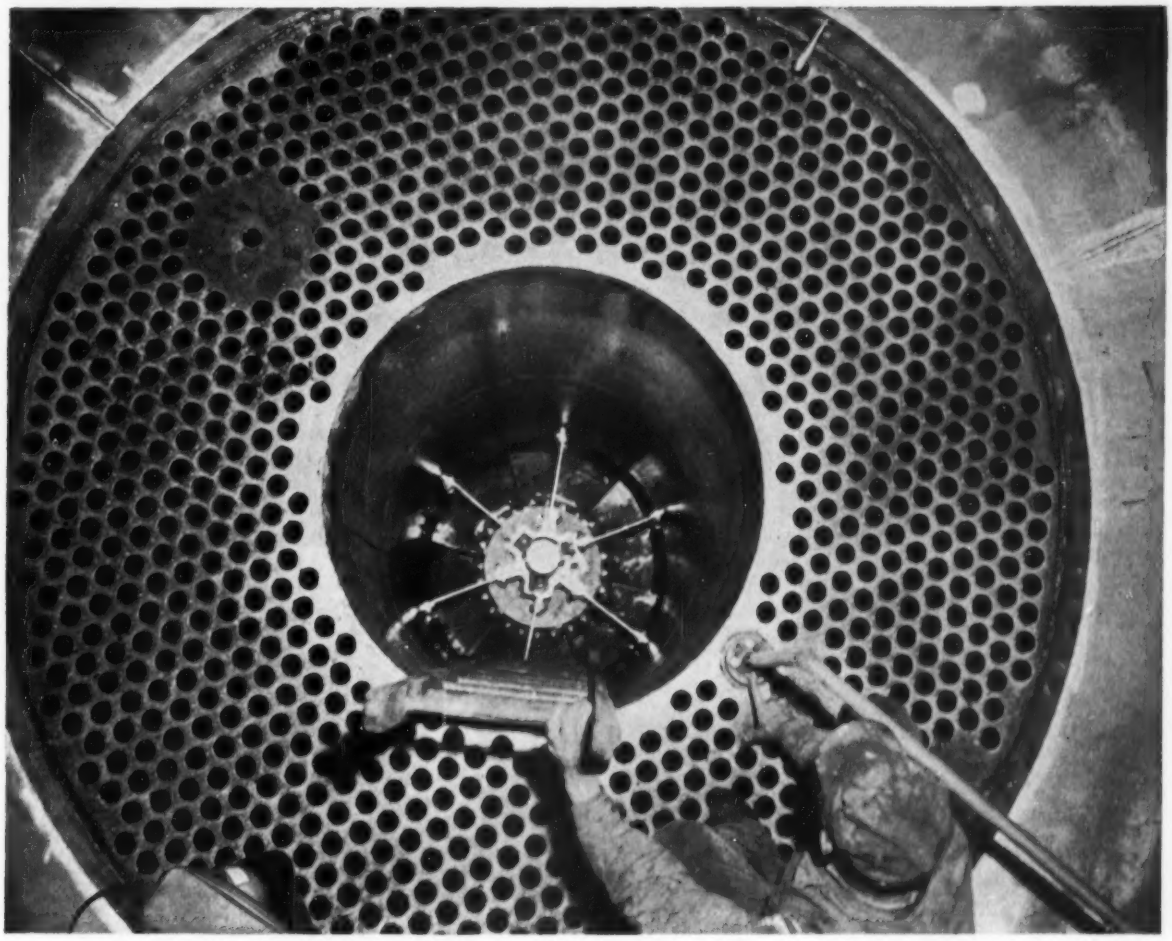


THE world's first atomic powered underwater ship—United States Navy Submarine Nautilus—carries within her hull, special valves engineered and manufactured by AE .

The same engineering skill and craftsmanship which AE contributes to the maritime alertness of the Nautilus, is available to you in meeting the problems of your research and development work. Consult with us on your pilot plant and laboratory requirements for high pressure equipment.

AUTOCLAVE ENGINEERS

2930 WEST 22ND STREET • ERIE, PENNSYLVANIA



Switching to *Carpenter* Stainless Tubing pays off 5 ways!

How can *you* use the five advantages gained by a prominent distillery when it changed to Carpenter Stainless Tubing for a new stillage evaporator?

Twice the service life . . . greater operating efficiency . . . lighter weight . . . greater carrying capacity . . . and a higher cost-life ratio are the proven results obtained with more than a mile of Carpenter Stainless Tubing in this evaporator.

Additional proof of how Carpenter quality pays off on job after job is available from your Carpenter Distributor. Discover the profitable difference Carpenter can make on your own processing and transfer lines, evaporators, heat exchangers and similar applications.

Talk to your Carpenter Distributor now about cost-savings you may be able to obtain by switching to Carpenter Stainless Tubing or Pipe. Remember, you are sure of getting the highest possible degree of perfection in Carpenter tubing because it must pass the most exacting non-destructive test ever applied to stainless tubing.

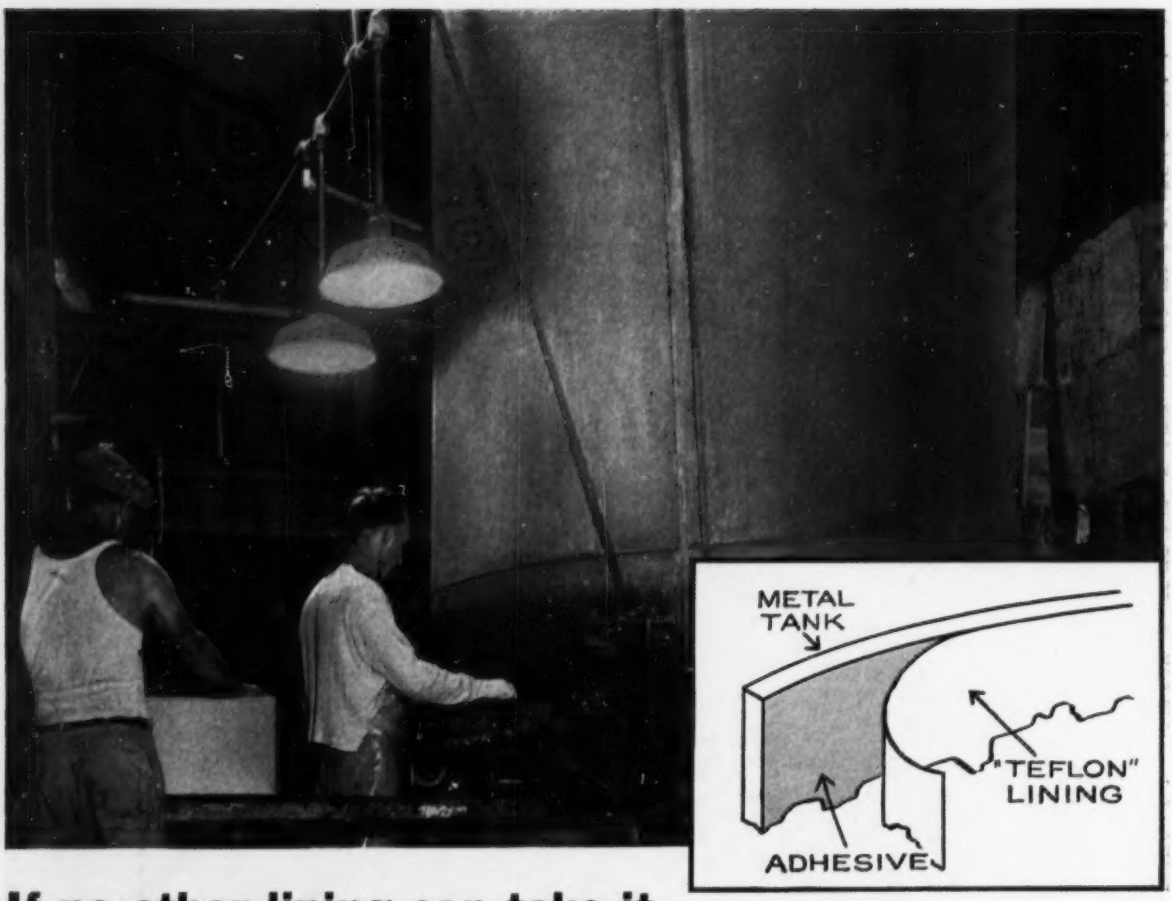
MEMBER

The Carpenter Steel Company, Alloy Tube Division, Union, N.J.

Export Dept.: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"

Carpenter

Stainless Tubing & Pipe



If no other lining can take it

Specify R/M BONDABLE Teflon*

Whether for lining tanks, kettles, spray booths, guard rails on conveyors, or for other purposes—you can depend on R/M Bondable "Teflon" to take anything that comes. It is impervious to all known industrial acids, caustics and solvents. It is noncontaminating, nonabsorbent, will not harbor bacteria. Nothing will stick to it on the untreated surface, but the bondable surface is easily cemented to a great variety of materials.

Sodium-etched on one side, R/M Bondable "Teflon" offers excellent adhesive characteristics when applied with conventional adhesives as the bonding agents. Linings will be ready for use after standing overnight at room temperatures, or in shorter times after being cured with heat.

For those processors who do not wish to line their own tanks, R/M provides a complete "Teflon" factory-lining service under the supervision of highly skilled engineers.

R/M Bondable "Teflon" tape is available to processors in thicknesses from .005 to .060 in., widths from ½ to 18 in. It is also available in sheets in thicknesses from 1/16 to ¾ in. and in 24 x 24, 24 x 48, and 48 x 48 in. sizes.

R/M Bondable "Teflon" is just one of the many "Teflon" products for your industry. The full line includes packings, gaskets, expansion joints, and many other forms. Write for more information.

*Du Pont trademark

Address all inquiries on R/M Bondable "Teflon" and other "Teflon" products to:

PLASTIC PRODUCTS DIVISION
Raybestos-Manhattan, Inc.
Manheim, Pa.

Address all inquiries on R/M's tank-lining service to:

MANHATTAN RUBBER DIVISION
Raybestos-Manhattan, Inc.
Passaic, N.J.

R/M

RAYBESTOS-MANHATTAN, INC.

PLASTIC PRODUCTS DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Engineered Plastic, Industrial Rubber, and Sintered Metal Products • Packings • Asbestos Textiles • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Laundry Pads and Covers • Bowling Balls

he's working for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country — and world — penetrating the plants, laboratories and management councils . . . reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it" — "they" being all the industry's front line of innovators and improvers — and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

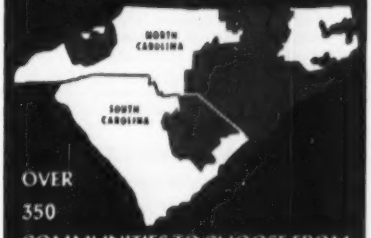
SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

McGRAW-HILL PUBLICATIONS

WHERE TO BUY

Featuring additional Equipment, Materials, Supplies & Services for the Process Industry

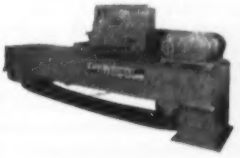
THE RIGHT LOCATION *for your operation*



OVER 350 COMMUNITIES TO CHOOSE FROM

(Address S. P. Vecker, Vice President Area Development Dept.

Carolina Power & Light Co.
RALEIGH / NORTH CAROLINA



FEED MATERIAL BY WEIGHT

MERRICK FEEDOWEIGHT

MERRICK SCALE MFG. CO.
171 SUMMER ST., PASSAIC, N. J.

TANK-O-METER
FOR MEASURING TANK CONTENTS ANY DISTANCE AWAY
ANY LIQUID
Uehling
INSTRUMENT CO.
491 GETTY AVENUE, PATERSON, N. J.
SEND FOR BULLETIN 945

Make it a habit

to check, each issue, the announcements appearing in this
WHERE TO BUY SECTION
They supplement other advertising in CHEMICAL ENGINEERING of products and services essential to modern chemical plant operation.

PROFESSIONAL SERVICES

PROCESS DEVELOPMENT & PILOT PLANT WORK
PLANT CONSTRUCTION & ERECTION
PROCESS & PLANT DESIGN
EVALUATION AND APPRAISAL
EQUIPMENT DESIGN
SYSTEMS ENGINEERING
INSTRUMENTATION
CATALYST DEVELOPMENT
PATENTS
CHEMICAL & BACTERIOLOGICAL ANALYSIS
TRANSLATIONS
PLANT SITE SELECTION
MANAGEMENT
GENERAL CONSULTING

R. S. ARIES & ASSOCIATES
Cosultants to the Chemical Industries
New Products and Processes
New Product Development
Design & Initial Operation of Complete Plants
Process Analysis — Market Research
COMPLETE TECHNICAL & ECONOMIC SERVICES
270 Park Ave. EL 5-1430 New York 17, N. Y.

KNOWLES ASSOCIATES
Chemical—Metallurgical—Mechanical Engineers
Consultation — Design
Complete Plants — Equipment
Heavy Chemicals — Ore Dressing
19 Rector Street New York 6, New York
Bowling Green 9-2456

SANDERSON & PORTER ENGINEERS
DESIGN
CONSTRUCTION
New York New York

W. L. BADGER
CONSULTING CHEMICAL ENGINEER
Evaporation, Crystallization, and Heat Transfer; Complete plants for salt and caustic soda; Complete Deutsche Installations.
369 South State Street Ann Arbor, Mich.

THE KULJIAN CORPORATION
Consultants • Engineers • Constructors
Chemical • Industrial • Process
1700 N. Broad St. Phila. 21, Pa.
Offices Throughout the World

J. E. SIRRINE COMPANY
Engineers
Plant Design & Surveys covering Chemicals, Electrochemical and Metallurgical Production; Trade Waste Disposal; Water Supply & Treatment; Analyses & Reports.
Greenville - - - - - - - - - - South Carolina

CARTER & NANSEN CO., INC.
DISTILLATION—ABSORPTION
Plants — Process — Equipment
420 Lexington Avenue New York 17, N. Y.

R. B. MACMULLIN ASSOCIATES
Chemical and Electrochemical Plants
Complete Process and Project Engineering
Research Guidance Economic Surveys
610 Hancock Bldg. Niagara Falls, N. Y.

TECHNICAL ENTERPRISES, Inc.
Engineers—Consultants—Chemists
to
Chemical — Food — Pharmaceutical Industries
Complete Engineering Services
Product & Process Research & Development
SPECIALISTS IN SMALLER MANUFACTURING PLANTS
31 South St., New York 4, N. Y. WH 3-1544

CARL DEMRICK
Technical Translations
Send for Circular
58 So. Broadway Yonkers, N. Y.

METCALF & EDDY
Engineers
Industrial Waste Treatment
Water Supply and Water Purification
Stream Pollution Investigations
Laboratory
Statler Bldg. Boston 16

TRANSDYNE CORPORATION
Manufacturing Engineers
•
Specialists in the application of Electronics to Process Industries
•
Temperature, Photoelectric, Digital, Analog, Flow Controls designed for specific applications.
7237 Grand Ave. Maspeth 78, New York

D. Q. KERN ASSOCIATES
Thermal Process Technology
A Supporting Staff of Fifty Engineers, Designers, Detailers
7016 Euclid Ave., Cleveland 3, O.
52 Wall St. New York 5. 636 Wyatt Bldg Washington 5

PATCHEN AND ZIMMERMAN ENGINEERS
Chemical, Process, and Industrial Plants
Investigations — Reports — Design — Supervision
Augusta, Ga. Atlanta, Ga. Anniston, Ala

UNITED INTERNATIONAL RESEARCH INC.
Specialists in the chemistry, electrochemistry and production of fluorine, chlorine and iodine tungsten, chromium, boron, titanium, uranium, selenium, manganese, cobalt, and nickel and their compounds
38-15 30th Street Long Island City, N. Y.

KOHN & PECHENICK
Consulting Chemical Engineers
Plants — Process — Equipment
DESIGN
Reports Trouble-Shooting Appraisals
982 Huron St Brooklyn 22, N. Y.

PILOT ENGINEERING COMPANY
RESEARCH & DEVELOPMENT
From idea through pilot plant
DESIGN
Process — Equipment — Complete plants
PRODUCTION
Supervision — Trouble shooting
Improvements — By-product recovery
P. O. Box 54 Brooklyn 5, N. Y.

THE J. G. WHITE ENGINEERING CORPORATION
Design - Construction - Reports - Appraisals
80 Broad Street, New York 4

"By reason of special training, wide experience and tested ability, coupled with professional integrity, the consulting engineer brings to his client detached engineering and economic advice that rise above local limitations and encompasses the availability of all modern developments in the fields where he practices as an expert. His services, which do not replace but supplement and broaden those of regularly employed personnel, are justified on the ground that he saves his client more than he cost him."

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Services
Labor Bureaus

DISPLAYED —RATES— **UNDISPLAYED**

The advertising rate is $23.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$1.80 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Position wanted ads are ½ of above rate.
Box Numbers—counts as 1 line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
Not subject to Agency Commission.

Send NEW ADS or Inquiries to Class. Adv. Div. of CHEMICAL ENGINEERING, P. O. Box 12, N. Y., 36, N. Y. November Issue closes October 2nd.

CHIEF MECHANICAL ENGINEER

Staff position directing plant engineering functions in 4 plant operation. Opportunity, prestige, responsibility and authority in nationally known Co., Starting salary $12,000 plus bonus. Employer assumes agency fee and relocation expense.

28 E. Jackson Blvd. Chicago 4, Ill.
MONARCH PERSONNEL

CHEMICAL ENGINEERS

An active, confidential service! Interview at your convenience.

Call, write or wire
GLADYS HUNTING (Consultant)
DRAKE PERSONNEL, INC.
220 So. State St. Rm. 628 Chicago 4, Ill.
HArrison 7-8.00

REPLIES (Box No.): Address to office nearest you c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

POSITION VACANT

Man with Technical background in Mechanical or Chemical Engineering to sell special equipment. Must be free to travel. Headquarters on Long Island, New York. P-2884, Chemical Engineering.

SELLING OPPORTUNITY OFFERED

Manufacturer of Heat-Transfer apparatus & pressure vessels required additional sales representation in East. Contacts in Chemical Plants. Marine, oil refineries and power plants desirable. RW-1952, Chemical Engineering.

EMPLOYMENT SERVICES

Salaried Positions $5,000 to $35,000. We offer the original personal employment service (established 46 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 533 Brisbane Bldg., Buffalo 3, N. Y.

Salaried Personnel $5,000-$35,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection, under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L. P. O. Box 674, Manchester, Vermont.

POSITIONS WANTED

Management position with progressive fertilizer company. B. S. Agriculture Chemistry 1949. Age 37, family. 8 yrs. experience production & sales commercial fertilizer. 4 yrs. plant supervision. 4 yrs. manager plant 50,000 annual tons. Minimum $9,500. PW-2812, Chemical Engineering.

Licensed Engineer. M.E. and E.E. 25 years experience Maint. Engin. and Constr. mining, smelting and chemical plant. Age 47. Desires position change. PW-2988. Chemical Engineering.

ADDITIONAL EMPLOYMENT ADVERTISING ON PAGES 424-426

PROJECT LEADER
Chemical Engineer

A challenging position is open for an experienced Chemical Engineer to act as project leader. This position is concerned with pilot plant design, construction, and operation.

This position requires a man with a degree in Chemical Engineering and extensive experience in moderately high pressures. You may use your initiative and creative ability and work with other leading scientists in this field.

We offer excellent employee benefits, opportunity for advancement, and a good salary. Please send resume to:

Mr. J. A. Metzger
ARMOUR RESEARCH FOUNDATION
of
Illinois Institute of Technology
10 West 35th Street
Chicago, Illinois

PLANNING ENGINEER

CHEMICAL — METALLURGICAL

JOB: broad company-wide planning with nationally known non-ferrous metals firm.
EXPERIENCE REQUIRED: extractive metallurgy and/or heavy chemicals. Economic evaluation. Salary open. Send complete resume—age, training, experience, salary desired.

P-2691, Chemical Engineering
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

ASSISTANT CHIEF ENGINEER

Age limit 45. Must be graduate mechanical, chemical or civil engineer with natural mechanical ability, excellent practical and supervisory and some construction experience, for charge under Chief Engineer of all shops, foundry, mobile equipment including loading, marine, railway and construction; maintenance and repair of all types of equipment; 7200 KVA diesel generating plant. Mine and mill 2600 tons/day. Flotation Mill Copper. Salary open. Foreign. With initial letter send full experience, references, age, marital status, number and age of children. Reply: Cyprus Mines Corporation, 523 West Sixth Street, Los Angeles 14, California.

CHEMICAL ENGINEERS

$5,000—$14,000

Openings with top Twin Cities firms in plastics, coatings, vegetable oils and fats and other industrial chemicals mfg. Executive and administrative as well as production and process. Send resume to

WALKER EMPLOYMENT SERVICE
212 So. Seventh St., Minneapolis 2, Minnesota

TOP-FLIGHT
ENGINEERS
DESIGNERS
DRAFTSMEN

McKEE has openings for top men to fill important, permanent positions, with excellent prospects for promotion to supervisory, staff and executive posts in our expanding organization.

Our Metals, Refinery and Industrial Divisions offer you wide choice of opportunity to make fullest use of your talents in the design of refineries, blast furnaces, steel, sintering, chemical and industrial plants and their auxiliaries.

Investigate the advantages of top compensation, ideal working conditions, employment security, advancement opportunity and many generous benefits available to you at McKee.

Telephone TOwer 1-2300, Cleveland, Ohio or write to Edward A. Kolner, Arthur G. McKee & Company, 2300 Chester Ave., Cleveland 1, Ohio

Arthur G. McKee & Company

Engineering offices in
CLEVELAND, OHIO • UNION, N.J. • TORONTO, ONT.

SEE CHEMSTRAND'S AD on Page 289 of THIS MAGAZINE

Positions available for

ENGINEERS

(Chemical, Mechanical, Metallurgical, Textile, Industrial, Instrument and Civil) and

CHEMISTS

(Organic, Physical, Analytical—Instrumental and Wet Method, Textile Chemists.)

Write to Technical Personnel Department

THE
CHEMSTRAND
CORPORATION
Decatur, Alabama

CHEMICAL ENGINEERS:

There are outstanding career opportunities with one of the 100 largest corporations in the United States for men with the following qualifications:

- **One to five years experience in petroleum refining or related activities.**
- **B.S. or higher degree and experience in development, pilot plant operation, process design, process trouble shooting, refinery process engineering, economic studies or related work.**
- **Age range . . . 22-32.**

Choice positions open in Cleveland, Toledo and Lima, Ohio.

Write, giving a complete resume of your education, experience and personal data to:

CLYDE A. BRUGGERS

1737-A Midland Building, Cleveland 15, Ohio

There's a bright future waiting for the right men with

THE STANDARD OIL COMPANY (OHIO)

RESEARCH ENGINEERS

Unusual opportunity to do stimulating work in Chemical Engineering or Reactor Technology research on pilot plant or laboratory scale. Several years experience desirable in reactor water technology, reactor economics, or radiochemical techniques.

Opportunities to direct projects or work under experienced men. These are permanent positions offering professional and personal growth. Please send resume to

Mr. J. A. Metzger

ARMOUR RESEARCH FOUNDATION

of

Illinois Institute of Technology

10 West 35th Street

Chicago, Illinois

HIGH TEMPERATURE TECHNOLOGY

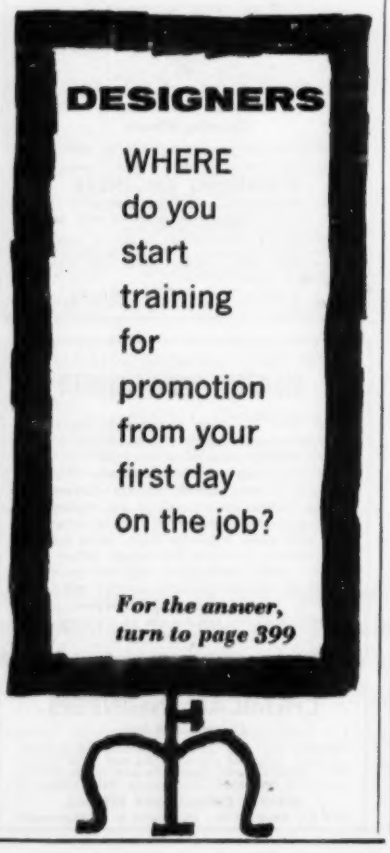
Interested in High Temperature Reactions? An exceptional opportunity for chemists, physicists or engineers to work in a new laboratory devoted to an intensive study of high temperature reactions for development of new thermally and chemically stable products for industry.

The men we want should have a working knowledge of thermodynamics, physical chemistry and heat flow or an interest in the evaluation of high temperature products.

Emphasis will be placed on the study of solid state or gaseous reactions occurring above 2000°C and evaluation of commercial possibilities of the reaction products.

If you are interested in working in this challenging field of high temperatures in a modern, well equipped laboratory for a leader in high temperature technology, please call or write to:

Dr. N. J. Johnson
Director, Development Laboratory
National Carbon Company
A Division of Union Carbide and Carbon Corporation
Niagara Falls, New York



MECHANICAL AND CHEMICAL ENGINEER

Unusual opportunities for graduate Mechanical and Chemical Engineers for an expanding manufacturer of heat exchangers, surface condensers and steam jet ejectors. We have several openings in all phases of engineering, from Design to Sales, offering an engineer a secure, stable job created by normal, steady, upward growth of the Ross organization. Young, ambitious engineers have a future at Ross. Please submit resume and salary desired to:

Employment Manager
Ross Heat Exchanger Division
American-Standard
1407 West Avenue, Buffalo 13, New York

Process Engineer

A chemical or mechanical engineer with at least five years industrial experience, to analyze technological, economic and procedural problems in the manufacture of pulp and paper. An opportunity for significant achievement. Salary open. Apply to Personnel Dept., West Virginia Pulp and Paper Company, 230 Park Avenue, New York 17, N. Y.

WANTED
TECHNICAL EDITORS

To provide for its continued growth Chemical Week is seeking two additional assistant editors—preferably chemists or chemical engineers with two to three years business experience. Essential: Ability to meet people, dig out facts, interpret them intelligently and write lucidly. Please submit resume to:

PERSONNEL DIRECTOR
McGRAW-HILL PUBLISHING CO.
330 W. 42ND ST.
NEW YORK 35, N. Y.

CAREER OPPORTUNITIES WITH PHILLIPS 66

DESIGN ENGINEERS, DESIGNERS and DRAFTSMEN

Chemical, electrical, mechanical, structural, and architectural engineers, designers, and draftsmen needed for design of oil and petrochemical facilities.

INSTRUMENTATION ENGINEERS

Engineers having knowledge of pneumatic, hydraulic and electrical automatic instruments, and experience in application to continuous processes.

MATERIALS HANDLING and PACKAGING ENGINEERS

Requires knowledge and experience in materials handling as related to sales, refining, and petrochemical operations.

WATER TREATING ENGINEERS

Engineers with experience in industrial water treating and the treatment of industrial wastes.

OTHER ENGINEERS

Graduate engineers for construction of oil and petrochemical facilities. Metallurgical engineers for analyzing service failures and evaluation of materials and equipment.

Excellent working conditions and employee benefits program.

Write, giving qualifications and experience, to:

Phillips 66

Manager
Employee Relations Division
Engineering Department
PHILLIPS PETROLEUM CO.
Bartlesville, Oklahoma

FERTILIZER ENGINEER

An opportunity lies in a newly created position for a graduate chemical engineer with a minimum of 2 years experience in mixed fertilizer manufacturing. Liaison functions between production, inspection, research, and management.

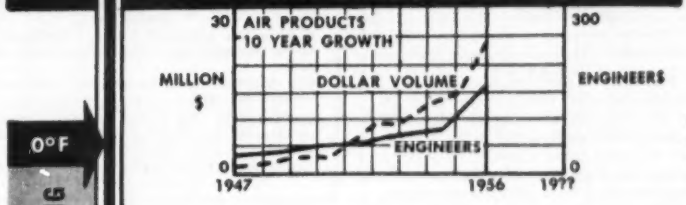
Industrial or mechanical engineering experience helpful. Kansas City location. Salary open; liberal employee benefits. Reply in confidence stating age, full personal history, experience, education, and salary requirements.

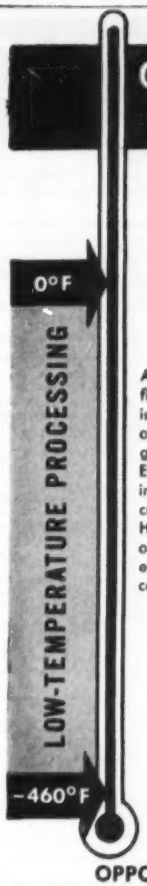
CONSUMERS COOPERATIVE ASSOCIATION

Box 2359 Kansas City 42, Missouri

Attention: Employment Manager

Chemical & Mechanical Engineers OPPORTUNITY





Air Products offers you the opportunity to advance professionally and financially in the field of low temperature processing. The company is the leader in the engineering, design, manufacture, and construction of oxygen plants and systems for the separation of low boiling point gases such as Oxygen, Nitrogen, Carbon Monoxide, Hydrogen, Methane, Ethane, Ethylene and other basic building blocks of the petrochemical industry. We must expand the entire organization to meet the increasing demands of the steel, metallurgical, and chemical industries. Huge plants are being constructed to meet the liquid oxygen demands of the guided missiles program. We need chemical and mechanical engineers who want to share in the growth and profits of a dynamic company in a new and basic industry.

Openings are available in Process Design, Project Engineering, Estimating and Economic Evaluation, Equipment Design, Sales Engineering, Manufacturing Engineering, Supervision of Oxygen Plant Operations and other areas for which you might be qualified. To arrange confidential interview, send resume to Technical Personnel Manager.

Air Products
INCORPORATED
P. O. Box 538 Allentown, Penna., U.S.A.

OPPORTUNITIES IN RESEARCH & DEVELOPMENT

We also need engineers who are interested in applying the principals of thermo dynamics, fluid flow, heat and mass transfer, vapor-liquid equilibria, etc. to the solution of complex new problems in low temperature technology including distillation, adsorption, absorption, physical property experimentation, analytical methods and instrumentation, process development, pilot plants, equipment development including process apparatus and machinery items such as turbines, pumps, expanders, compressors and many other interesting and classified projects.

ESSO ENGINEERING IS ←EXPANDING→

CHEMICAL ENGINEERS NEEDED

Career openings available in long range expansion program. Work involves process planning, economics, design, and occasional field follow-up.

Prefer men of high scholastic rating and with one to seven years experience. There are also a number of openings for very recent graduates. Both Bachelors and Masters degree positions are available. Salary commensurate with experience and qualifications.

If you are interested in an opportunity for growth and promotion with a leader in the petroleum industry, write today giving full details of education, experience, salary desired, availability date and references.

All inquiries will be considered promptly and held confidential.

ESSO
RESEARCH AND ENGINEERING COMPANY

ESSO RESEARCH CENTER
EMPLOYEE RELATIONS-C

P. O. BOX 51
LINDEN, N. J.

EMPLOYMENT OPPORTUNITIES

(Continued from pages 423-425)

CHEMIST

Outstanding and challenging opportunity for capable Chemist or Chemical Engineer with experience in high polymers to assist Chief Chemist in applied research and product development of a broad range of end products in rubber, plastics, and finishes' field. Will operate in capacity of Project Leader. Desire a man with plenty of brain power who at same time has potential for administrative growth. Advanced degree desirable.

Here is a chance to advance with an old line but growing company who are world-wide leaders in the recreation and educational equipment fields.

Attractive salary and fringe benefits available. Employment bonus of one-month's salary for the successful candidate.

Send resume or write to:

Personnel Manager
The Brunswick-Balke-Collender Co.
Muskegon, Michigan

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES — **EQUIPMENT - USED or RESALE**

RATES

UNDISPLAYED

$1.80 a line minimum 3 lines. To figure advance payment count 5 average words as a line.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED

The advertising rate in $16.95 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

Send NEW ADVERTISEMENTS or Inquiries to Classified Advertising Div. of Chemical Engineering, P. O. Box 12, N. Y. 36, N. Y. for November issue closing October 2nd

NEW AND GOOD-AS-NEW EQUIPMENT

1—Stainless Tank #430 Chrome, vert. 7'x10' deep.
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1—Day Mixer, steam jacketed, 50 gal. Sigma Blade.
1—Copper Evaporator, steam jacketed, 9'1"x3'9".
68—New Pressure Cookers, 18"x18" & 24"x28".
150—Pumps—steam and electric.
1—New Glass Nash Centrifugal Pump, 150 gpm.
1—New Nash Vacuum Pump Type AL-572.
1—Buflovak Jacketed Impregnating Tank 42"x52".
1—Stedman Disintegrator, size 40-6.
1—Abbe Ball Mill, 36"x42" Buhrstone lined.
#316 Stainless Steel Tanks, new 100, 200 & 360 gal.
1—Nash Air Compressor, Type AL-623.
1—Manton Gaulin Stainless Homogenizer, 125 gph.
1—I&R Vacuum Pump, 5 H.P., 60'.
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1—Raymond 6" Hammer Mill, like new.
Davenport Rotary Steam Tube Dryer, 6'x36'.
1—New Louisville Continuous Filtering Machine.
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Rogers Special 6' stain. steel.
Exchanger, heat: Walker Wallace st. steel, plate type, 200 GPH.
Filters: Oliver 2½ x 1', Sparkler, Alsop, Lomax, Industrial, Oliver 3' horizontal.
Filter Presses: Sperry, Shriver 6" to 36".
Kettles: Stainless steel 20 to 150 gal., with and without agitators.
Devine 1500 gal. jacketed agitated.
Dopp 150 gal. dbl. act. st. agitator.
Mills: Pebble, Abbe #5, 36 gal.
Ball: Hardinge 6' x 36" buhr. lined.
Mikro: 2 DH, 10 hp. New.
Hammer: Jeffrey 30 x 24" type A.
Hammer: Williams size BX type AK.
Raymond: 6000 IMP, 16" screen mill.
Raymond laboratory Screen Mill.
3-roll: Ross 12 x 30". Day 12 x 32".
Mixers: Dbl. and sgl. arm sigma blade.
Day Imperial #10 st. steel.
Dry Powder: 1½ to 77 cu. ft.
Dry Powder: Day copper body, 27 cu. ft.
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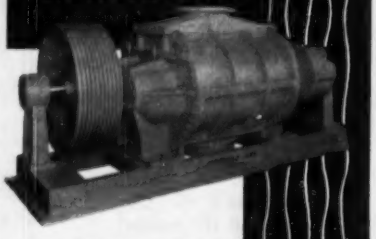

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1—Rotex 4' x 7'—2 deck sifter.

1—Trough conveyor 14" x 86' center.

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2—Pfaudler 2500 gal. Vertical, closed Tanks with S.S. coils.

Steel

30—Graver 40"x37" high, Vertical Tanks, side jackets, 2400 gal.
21—Graver 40"x7" Vertical Tanks, side jackets, 500 gal.
5—Vertical, closed Tanks 10,000 and 20,000 gal. with flame arrestors.

CENTRIFUGES & FILTERS

11—Podbielniak, Model 6900 and 6060 S.S. Extractors, 10 HP XP motors.
1—Bird 40" suspended Centrifugal, bottom discharge with 30/7½ H.P. motor.
1—Bird-Young 4'x2' steel Rotary Vacuum Filter with copper screening.
1—Republic 15"x15" S/S "Flexo-Master" Filter Press 20 chambers.

DRYERS

2—Kathbar Dehumidifying units Models 500 BLT and 250B with accessories.
5—Stokes Vacuum Shelf Dryers having 8—44"x40" shelves.
5—National Research Vac. Diffusion units Model V-10-D.

COMPRESSORS & PUMPS

6—Ingersoll Rand Air Compressors 480 to 1500 cfm with motors.
10—York Ammonia Compressors, Model D-8, 10"x7½", 8"x6", 6"x6", 5"x5" and 4"x4" with motors and accessories.
10—Kinney Vacuum Pumps 100 and 200 cfm.
1—Nash Vacuum Pump 300 cfm.
68—Ingersoll Rand, Peerless, Dayton-Dowd and Worthington Stainless Bronze and Steel Centrifugal Pumps ⅓ to 20 H.P.

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2—Water Stills 100 GPH and 50 GPH, steam heated.
1—Bantam Mikro Pulverizer, S.S.
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1—Stokes 2' x 6' Rotary Vac. Dryer.
1—Albright-Nell 4' x 9' Atmos. Drum Dryers.
1—Buffalo Vac. Drum Dryer 24" x 28".

CENTRIFUGALS & CENTRIFUGES

4—Tolhurst 40" Suspended Type Centrifugals.
8—Centrifugals 12", 30", 40" & 48" Steel, Copper, Stainless & Rubber Lined.
6—Sharples Centrifuges #5A Stainless. Also #6.
3—De Laval Multiple Clarifiers #200, 300 & 301.

FILTERS

#2 Sweetland Filter 12 Stainless Covered leaves.
1—Vallez 41 Stainless Covered Leaf Filter, types 48.
Sperry & Shriver 7" to 36 sq. in. Iron & Wood.
Gen. Amer. 2' x 1' Rotary Vac. Filter.

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Pfaudler 250 gal. Glass Lined Closed Jack. Kettle.
1—Dopp 350 gal. C. I. Jack. Vac. Kettle.
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Devine 1000 gal. closed Jack. Steel Kettle.
1—2300 gal. Vert. agit. Jack. Steel Kettle.
8—Jacketed Kettles 50 to 2300 gals.
1—250 gal. Lead-Lined Kettle.
Pfaudler 150 gal. closed agit. jack. Steel Kettles.
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#1 Raymond Automatic Pulverizer 20 H.P. motor.
1—Raymond #00 Pulverizer 30 H.P. Complete.
2—#0000 Raymond Mills.
Sturtevant #0.15" Hinged Hammer Mill.
Sturtevant Lab Swing-Sledge Mill.
Jeffrey 18" x 18" Single Roll Crusher.
Day Hercules Spike Crusher 1½ H.P. motor.
Hammer Mills & Pulverizers 3 to 50 H.P.
1—Schutz O'Neil 20" Pulverizers. Also # 1.
Williams #3 & 2xx Hammer Mills.
1—Robinson 18" x 22" Attrition Mill.
1—Lehman 4 Roll W.C. 12 x 36" Steel Mill.
3—Steel 3 Roll Mills 9"x32", 12"x30" & 16"x48".
3—Houchin 18"x36"; 4 Roll Granite Stone Mills.
Ball & Jewell Rotary Cutters Lab. & up.
2—U.S. & Premier 1½ H.P. Colloid Mills.

MIXERS & SCREENS

Day Imperial 75 & 150 gal. Jack. Mixers.
Baker Perkins double arm 100, 50 & 9 gals.
2—Read 50 & 100 gal. double arm mixers.
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Kent 3 H.P. Continuous Dry Mixer.
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3—Day 8, 15 & 40 gal. Pony Mixers.
2—Day Brighton 20 gal. Change Can Mixers.
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10—Dry Spiral Mixers 50 to 3000#.
12—Portable Elec. Agitators ¼ to 3 H.P.

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Rotary & Single Punch Tablet Machines, ½" to 4".
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1—Howe Mogul Barrell & Bag Packer.
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6—Devine Stokes & Buffalo Vac. Pumps.
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6—	"	10'	" x	11'
10—	"	9'	" x	13'

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Day 3'x10' SS Rotary Vacuum Dryer
Mikro #4TH Pulverizer, with 40 H.P. motor
Oliver SS 3'x4' Filter, complete unit
Bird, Cont. Vac. Filter, 4'x1', rubber covered
SS Single Effect Evap. complete unit, 700 gal.
Sharples SS Super-D-Canter, complete unit
AT&M 60" Centrifugal 316 SS, 10 HP motor
Raymond #40 SS Imp Mill with 40 HP motor
Rotex 40x84" Sifter, 3 deck, with 2 h.p. motor
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1—Link Belt Stainless steel Rotor louvre dryer Model 207-14.
1—Van Alst stainless steel jacketed 500 gallon Reactor with agitator.
1—Stokes Double Drum Dryer 5' x 12' ASME, complete
2—Stokes stainless steel Granulators Models #21-J -21H.

5—Ames 500 HP Steam Generators, 125 psi, 1953 built.
4—Bird Stainless Steel suspended type centrifuges with 40" perforated baskets complete.
1—Sperry Stainless steel 18" x 18" , 4 eye closed delivery Filter Press.
1—Baker Perkins stainless steel jacketed double arm vacuum mixer, 100 gallon, 40 HP motor.

MIXERS

1—Day type 316 stainless steel sigma blade jacketed Mixer, 200 gals.
10—Baker Perkins double arm sigma blade jacketed Mixers, 100 gal.
1—Readco Double arm sigma blade jacketed Mixer, 50 gallons.
1—Baker Perkins laboratory mixer, size 4AN2, .07 gal. cap.
1—Day 50 gallon gearless Pony Mixer.
4—Patterson side-entering agitators, with 25 HP Explosion-proof motor.

FILTERS

10—Sweetland #12 Filters with 72 stainless steel leaves.
1—Republic 15" x 15" stainless steel filters, 15 chambers.
2—Sperry cast iron 24" x 24" 4 eye closed delivery filter presses, 45 chambers each.
1—Sperry C.I. 36' x 36" 4 eye closed delivery plate and frame.
1—Oliver Rotary Vacuum Filter, rubber-lined, 3" x 8' complete.

AUTOCLAVES—KETTLES—TANKS

1—Struthers-Wells type 347, stainless steel autoclave, 1000 gallons capacity, 2000 psi.
1—Stainless steel vertical storage tank, 3300 gallons.
1—Stainless steel vertical tank with turbine type agitator, 2250 gallons.
1—Steel horizontal rubber lined storage tank, 10,000 gallons.
7—Aluminum horizontal storage tanks, 17,000 gallons.
11—Pfaudler glass lined storage tanks, 30-500 gallons.
1—H. K. Porter stainless steel jacketed, 500 gal. Reactor.
3—Aluminum vertical storage tanks, 12,-000 gallons each.
1—Pfaudler glass-lined jacketed Reactor, 200 gals.
1—Pfaudler glass-lined jacketed Kettles, 10 gallons.
6—Patterson steel jacketed Kettles, 2500 gallons each.

THE GELB GIRL OCTOBER 1956

CENTRIFUGALS

1—Baker Perkins Ter Meer type 316 stainless steel centrifugal filter HS-24".
1—AT & M stainless steel suspended type centrifuge with 18" suspended basket, complete with motor and plow.
3—Tolhurst suspended type centrifuges with 30" basket, complete with motor and drive.
1—Bird continuous centrifugal steel filter, 24" x 38".
1—AT&M stainless steel centrifuge, 48" imperforated basket, complete with motor and plow.
1—Fletcher stainless steel suspended type centrifuge 40" perforated basket, complete with motor.
3—Sharples stainless steel super-pressurite centrifuge, Model 16Y.
1—Delaval type 316 Multimatic centrifuge.

DRYERS AND KILNS

1—Stokes Rotary Vacuum Dryer, 30" x 12'.
1—Hardinge Rotary Dryer, 7'6" x 55'.
1—Buflovak Double Drum Dryer, 42" x 120", ASME complete.
1—Bartlett & Snow Rotary Dryer, 4'6" x 36'6".
1—Link Belt Roto Louvre Dryer, Model 502-20.

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Vote November 6, for sure.

Vote to elect the ones you want representing you. To keep the ones who are doing you proud. To get rid of the ones who are not so hot.

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Vote—so you and your children after you always can.

See You at the POLLS!

CHEMICAL ENGINEERING

Reader Service

A. J. BABKOW, MANAGER C. J. ROHRBACH, EDITOR

October 1956

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THIS MONTH'S

Products

• Your complete index to chemicals, materials, equipment and services taken from this issue's advertisements, new products departments and "Guide to Technical Literature."

• Products listed feature code numbers which show the page on which they appear. L (left), R (right), T (top), B (bottom) indicate ad location; A, B, C, etc. and a, b, c, etc. identify specific product items on an editorial page or in an ad.

• You can get information on any listings by circling its key number on the Reader Service Postcard (see inside back cover). Replies will come direct from the companies manufacturing the products.

Chemicals

Acetonitrile 446A
Acid
  Citric 121a
  Gluconic 121b
  Itaconic 121e
  Muriatic 326a
  Oxalic 121c
  Tartaric 121d
Acids, fatty, polymerized 446B
Acrolein 446C
Additives, inorganic 148A
Alcohol, tetrahydrofurfuryl, bulletin 206 52-3
Alcohols, fatty
  Color-stable 150E
  Unsaturated 446D
Alumina 293
Ammonia 119
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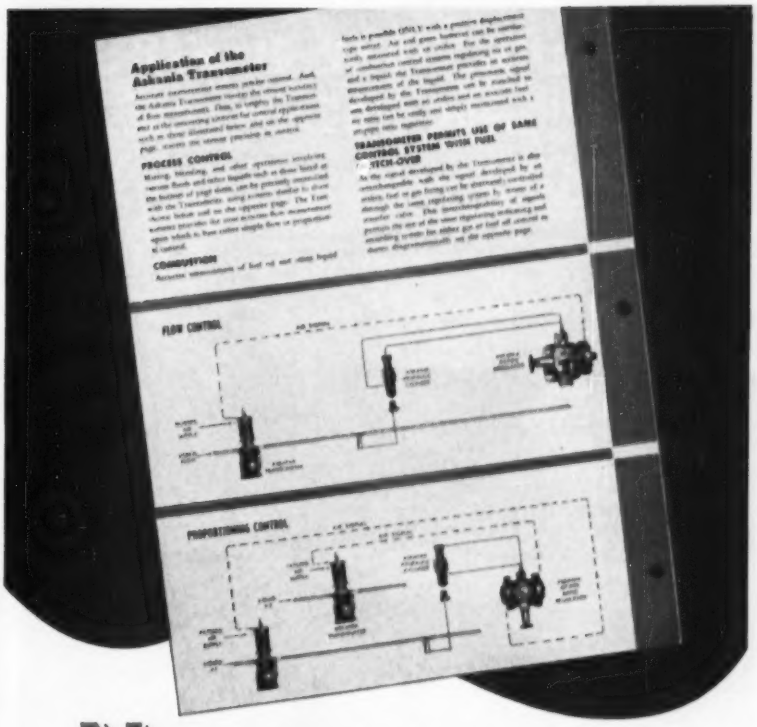

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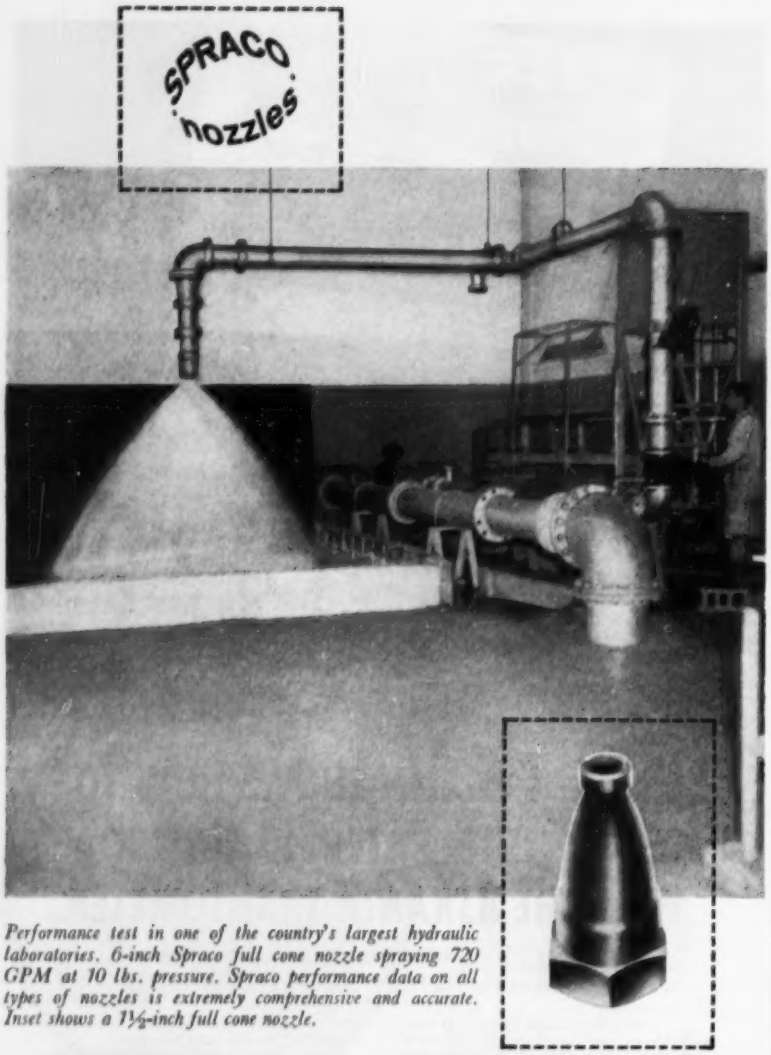

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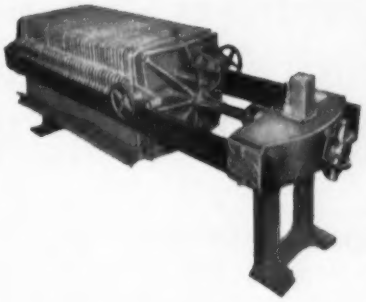

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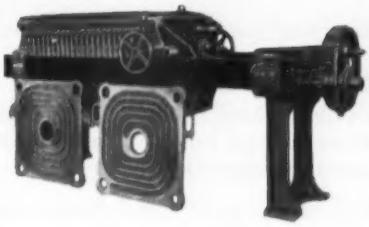

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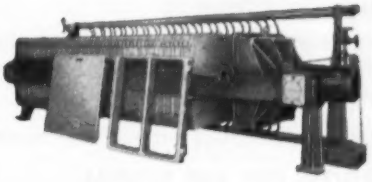

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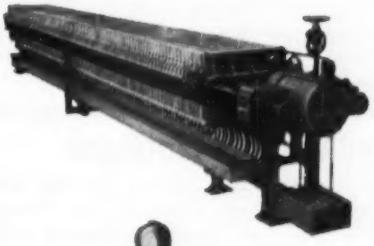

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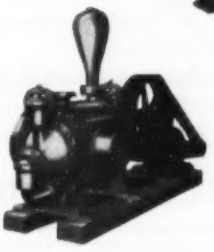

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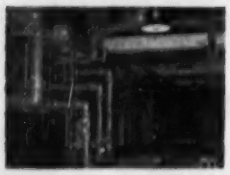

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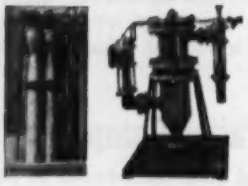

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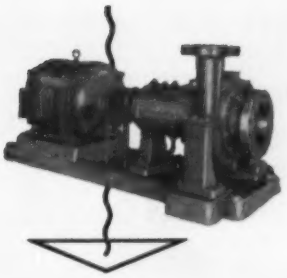

How to put the Indian Sign on your high temperature pumping problems

When you pump heat-transfer liquids at 600° F. or above, you run into some pretty tough problems. You have to keep the seal cool enough to prevent the heat from damaging it. Yet, you have to do this without cooling the liquid in the pump. The pump shaft must be big enough to avoid deflections that cause undue wear on seal and shaft sleeve. And the stuffing box better not leak—because heat transfer liquids are mighty expensive.

Dean Brothers put "the Indian sign" on every one of these toughies in their standard centrifugal process pumps. They did it with a simple, standard, readily-available mechanical seal. And they did it without the use of gimmicks or expensive auxiliary pressurizing equipment for the cooling liquid.

Engineering like this—plus mechanical reliability usually found only in costly, individually engineered pumps—means lowest cost in the long run—when operation, maintenance and replacement costs are fully considered.

For full information about Dean Brothers complete line of standard, heavy duty, centrifugal process pumps, Series 10, Series 20 and Series 30—to 7,000 gallons per minute capacity, send for Circular No. 184B.

INTERCHANGEABILITY OF PARTS MEANS MORE PUMP FOR YOUR MONEY

The eleven pumps in Dean Brothers Series 10 standard centrifugal pumps have a range of application that covers fully 90% of all process pumping applications. They're all built from the same standard parts with the exception of the Casing, Impeller and Suction Nozzle which determine each pump's capacity. For high temperature services the cradle housing is integrally water jacketed; for temperatures up to 350° F., it is not. Otherwise, all parts are completely interchangeable. Even the stuffing box that houses the mechanical seal will also accommodate conventional packing—another neat bit of standardization that eliminates special pumps for high temperature services.

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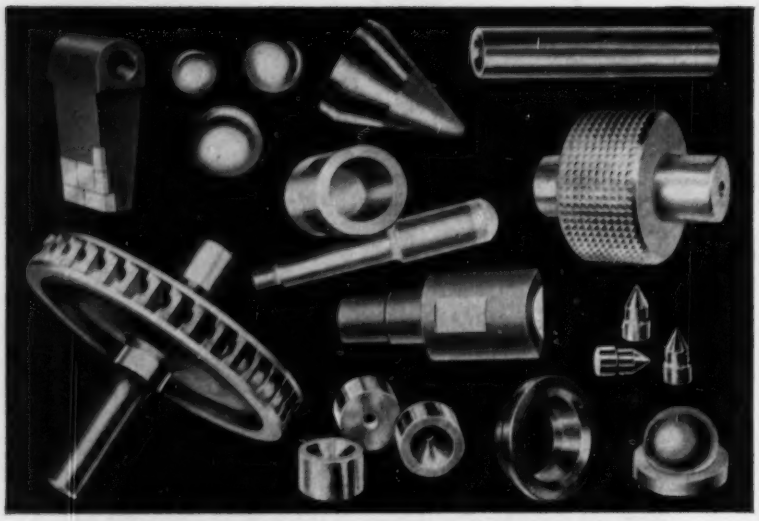
Centrifugal and Reciprocating Pumps • Since 1869



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More than 40 different standard Kennametal compositions have been developed to provide exceptional durability and long life under conditions where any one or a combination of the following destructive forces are met:

- abrasion
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- deformation
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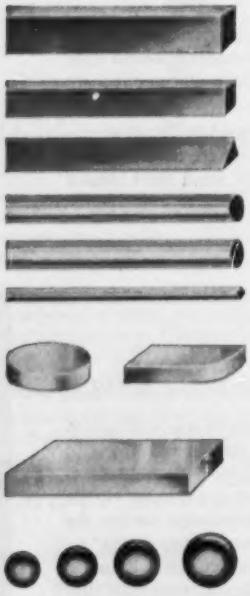
- hard impact or compression
- high temperature (1800°F and above)



Some of the many applications where these hard, strong and rigid sintered carbides are particularly effective in chemical processing include:

- balls for milling
- balls and seats for pumps
- bushings and guides
- compressor liners
- crusher parts
- mixer blades and parts
- nozzles
- pulverizing hammers
- turbine blades, rings, wheels
- valves, valve rings, valve seats

Kennametal is available in many standard forms, in addition to special shapes and parts, such as: rectangular blanks • discs • rods • tubes • flats • balls • rings • extruded, pressed, machined, and ground forms within precise tolerances.

Why not discuss your problems with your Kennametal carbide engineer. He can recommend the proper composition of Kennametal or high heat resistant Kentanium (for 1800 F° and above) to meet your specific requirements. Or write KENNAMETAL INC., Dept. CE, Latrobe, Pa. For more data, request booklet B-111, *Characteristics of Kennametal*, or B-222, *Designing with Kennametal*.

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it's integral!

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The fins of Trufin are squeezed right from the tube wall, are completely integral with the tube itself. That means longer on-stream time—more mileage when the going is tough.

Trufin can step up the capacity of your existing unit, when revamping, or can permit the design of a smaller unit (*with a bigger punch!*) when new heat exchangers are considered. Replace prime surface tube with Trufin Type S/T (low finned) in water-cooled condensers. Specify Trufin Type H/R (high finned) for air-cooled applications. Investigate the Trufin story—NOW! Write for the Trufin Opportunity Book.

Wolverine Trufin is available in a wide range of sizes and types in copper, copper-base alloys, aluminum and electric-welded steel.

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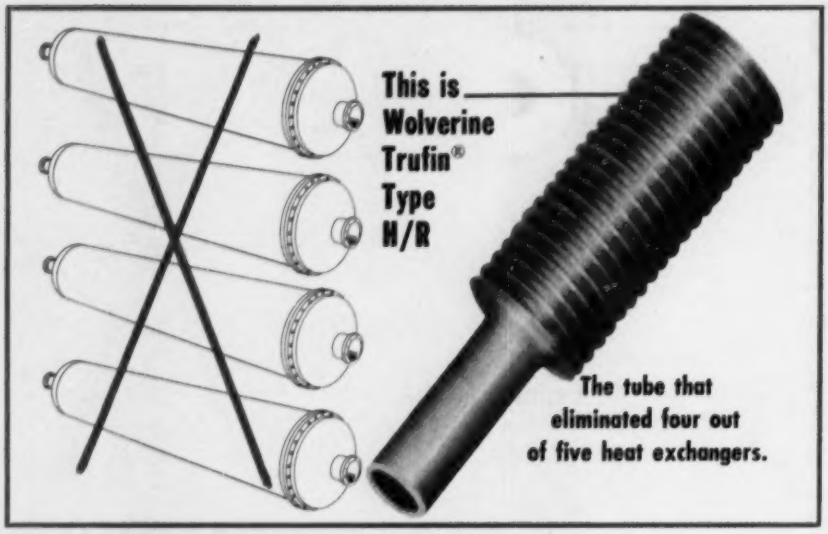

Here's a Real Success Story:

ONE TRUFIN TUBED HEAT EXCHANGER ELIMINATES FOUR PLAIN TUBE UNITS

By Ernest Dodd

UP NEAR the Canadian border, in a large chemical plant, processing engineers have a real look of respect in their eyes these days as they study the performance record of a certain heat exchanger.

There's every reason why they should because this is an amazing success story—one that would have delighted the heart of Horatio Alger, Jr.

The heat exchanger, which is tubed with Wolverine Trufin Type H/R condenser tube, was designed as the result of an alternate proposal made when management was considering plans for construction of an ethylene superheater.

The plan under consideration called for five plain tube heat exchangers capable of superheating 31,300 pounds per hour of ethylene vapor from minus 100°F to minus 20°F. Total heat duty amounted to 720,000 BTU's per hour.

The alternate proposal rocked management right back on its collective heels. Instead of five heat exchangers using a total of 5,680 *feet of plain tube* this plan called for the same heat duty to be achieved by *one exchanger tubed with only 2,790 feet of Trufin Type H/R condenser tube.*

It didn't take management long to make its decision. After all, one heat exchanger for five is a pretty fair deal in any league—especially when you consider the juicy savings in tube, shells, headers, baffles and labor.

No success story would be complete without a happy ending—and this one has it. After slightly more than one year of operation, the single Trufin-tubed unit has maintained top efficiency—*with a minimum of maintenance.* It has, according to the customer, met management's every expectation.

Integral Fins Give Wolverine Trufin More Surface Area

In the installation described at the left, hot ethylene liquid is used on the tube side to superheat ethylene vapors on the shell side.

For this particular type of operation, a high-finned tube such as Wolverine Trufin Type H/R is particularly effective because its integral fins give maximum heat transfer surface.

Trufin Type H/R is available with five to nine fins per inch in copper and copper-base alloys and with five to eleven fins per inch in lightweight aluminum.

Like the rest of the Trufin family of condenser tubes, Type H/R has integral fins squeezed directly from the tube wall. In addition to increasing surface area, the integral fins can never come loose from vibration, thermal shock or pressure variations.

Wolverine Tube Offers Free Trufin Literature

Wolverine's Trufin Catalog carries complete descriptions of each type of Trufin condenser tube. In addition to sizes, metals and alloys the catalog also describes the various applications where integral-finned tube can be used to full advantage. For your free copy write Wolverine Tube at the following address.

5407

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Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

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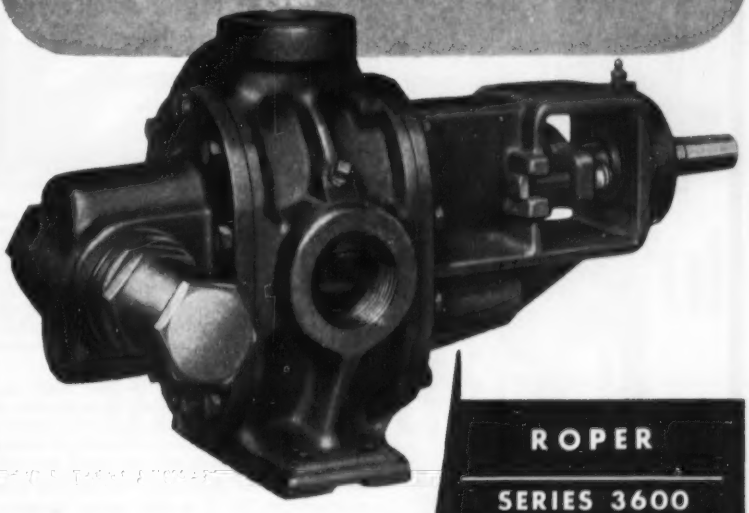

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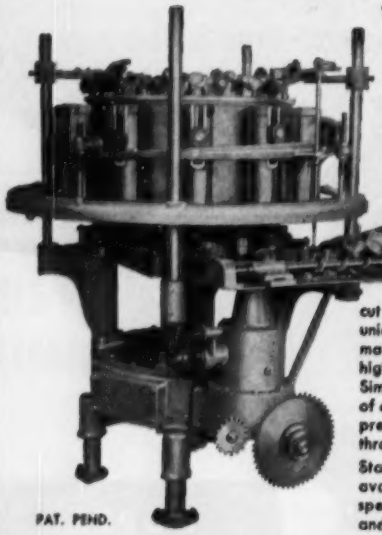

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You Get Higher Accuracy
Fast Change-Over
Lower Maintenance

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Standard one-quart and five-quart fillers are available in 6 to 36 station models to operate at speeds up to 800 CPM. Gravity, gravity pocket, and bottom fill models are also available to handle a wide variety of liquid and semi-liquid products.

Manufactured by Librascope, Inc. Exclusive sales representative: W. F. & John Barnes Company.

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Chemicals

Acetonitrile.....Technical information includes physical & chemical properties, solubilities of various materials in acetonitrile, specific reactions, physiological properties, etc. Request Bulletin F-7501D.
446A Carbide & Carbon Chem.

Acid, Muriatic.....Features high purity muriatic acid-Hooker White. This special grade is entirely free of arsenic. Contains .003% or less sulfates, & .0001% or less iron. Technical Data Sheet.
326a *Hooker Electrochem. Co.

Acids, Fatty, Polymerized.....New 20 p. booklet, titled "Empol 1022 Polymerized Fatty Acid" gives complete description, specifications, characteristics, considerable applications data and shipping data.
446B Emery Industries.

Acrolein.....New 24 p. booklet "Acrolein" includes physical properties, applications, typical reactions, derivatives, physiological properties, methods of analysis, shipping data, storage and handling, etc.
446C Carbide & Carbon Chem.

Alcohol, Tetrahydrofurfuryl.....New 28 p. booklet contains charts & tables, physical data & chemistry, uses, safety & physiological data, and general information. For details, see Bulletin No. 206.
52-3 *Quaker Oats Co.

Alcohols, Fatty, Unsaturated.....Technical Bulletin describes "Unadol 40", essentially a mixture of 9, 12-Octadecadienol and 9-Octadecenol. Includes suggested uses, physical properties, specification range, etc.
446D Archer-Daniels-Midland Co.

* From advertisement, this issue

Literature

Anhydrides.....Valuable 20 p. illustrated catalog describes Acetic, Propionic & Butyric Anhydrides, including test methods, specifications, physical properties & shipping data. Request Catalog F-5280B.
447A Carbide & Carbon Chem.

Bonding Agents.....New bulletin is a summary of currently available "Thixon" products for the adhesion of rubber and rubber-like materials to metal. Request Bulletin No. 03-1-5-5-56.
447B Harwick Standard Chem. Co.

Catalysts, Molybdenum.....Company offers a summary of the industrial uses of molybdenum catalysts. Data also given for promising applications still in the experimental stages. Request a copy of Bulletin Ch-11.
447C Climax Molybdenum Co.

Catalysts, Platinum.....Baker-developed platinum metal catalysts are available promptly, in any required concentration of metal—on the carrier and in the form best suited to your requirements. Request details.
229 *Baker & Co.

Chemicals.....Company makes available a new brochure listing the expanded line of Special & Rare Chemicals. Describes their activities in the distribution of Industrial, Laboratory & Rare Earth Chemicals.
447D City Chem. Corp.

Chemicals.....Typical Harshaw chemical products: electroplating salts, anodes and processes; vinyl stabilizers; fluorides; glycerine; synthetic optical crystals; fungicides. Request 16 p. booklet.
298 *Harshaw Chem. Co.

Chemicals, Agricultural.....New 28 p. book "Shell Agricultural Chemicals" gives general descriptions & information on the use for aldrin, dieldrin, endrin, Nemagon soil fumigant, D-D soil fumigant & allyl alcohol.
447E Shell Chem. Corp.

* From advertisement, this issue

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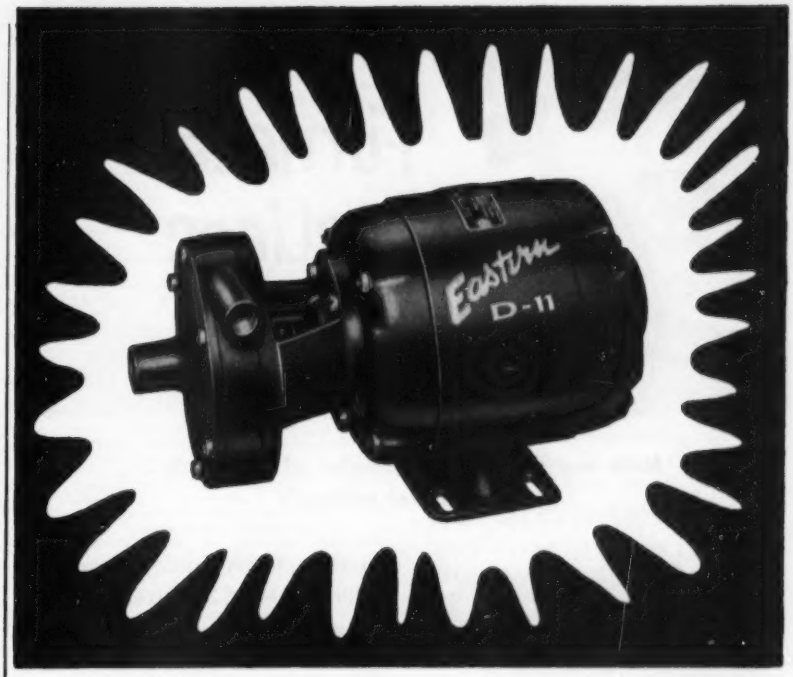

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For complete specifications on all Eastern Centrifugal Pumps, request Bulletin 120-B

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LITERATURE . . .

Chemicals, Organic.....158 p. illustrated catalog describes many synthetic organic chemicals. Includes complete physical property charts, and product index. Request "Synthetic Organic Chemicals".
448A Carbide & Carbon Chem.

Chemicals, Paint.....Tamms silica for paints, fillers and enamels; magnesium silicate; china clay and kaolin for pastes and cements; whiting for pottery trades; diatomaceous earth. Request prices and samples.
448B Tamms Industries.

Colors, Polyethylene.....Bulletin describes Stan-Tone GPE (granular polyethylene) Colors. Colors are compatible with polyethylene, vinyl & rubber. Includes color composition. Bulletin No. 02-124-2-6-56.
448C Harwick Standard Chem. Co.

Defoamers, Silicone.....Dow Corning "Antifoam B" disperses immediately in aqueous solutions. No stirring or agitation required. Ready to use & ideal for continuous processing. Request particulars and free sample.
L469 *Dow Corning Corp.

Degreasers.....Company offers brochure containing descriptive material on both Permacel 345 Degreaser and Permacel 340 Bite. Permacel 340 Bite is a new pre-paint cleaner and wax and silicone remover.
448D Permacel Tape Corp.

Elastomers, Carboxylic.....New 16 p. bulletin describes Hycar 1072X3. Includes tables of Geon & phenolic resin blends, Hycar 1072X3-phenolic resin cements, curing systems, plasticizers, etc. Bulletin H-21.
448E B. F. Goodrich Chem. Co.

Emulsions, Paint.....Bulletin covers physical properties, chemical and physical data, compounding properties, types of emulsions, formulations, instructions for use and trade names. Details in Form G101.
448F Shawinigan Resins Corp.

Fibers.....Information on the processing, carding, drawing, roving, spinning, plying, winding, and coning of Arnel and Arnel blended yarns. Properties of spun Arnel yarn are listed in Technical Bulletin TD-14A.
448G Celanese Corp. of America.

Formaldehyde.....High purity 50% and 37% formaldehyde is available at low cost from du Pont. Its methylene ($-CH_2-$) group functions as a "chemical button" to link similar or dissimilar molecules. Request details.
382d *E. I. du Pont de Nemours.

Gases, Compressed.....Company announces new catalog & price list of its compressed gases & gas regulators. Includes special gas mixtures for instrument calibration, nuclear flow counters, furnace atmospheres, etc.
448H Matheson Co.

Glycols.....New 61 p. booklet, "Glycols", a summary of Carbide's glycols, is a handy reference for people in the chemical industry. Includes physical property charts, specifications & test methods, etc.
448I Carbide & Carbon Chem.

Hydrogen Peroxide.....Describes various applications of hydrogen peroxide as a propellant . . . includes tables and graphs showing physical properties of 90% H_2O_2, apparent pH readings, etc. Bulletin 77.
448J Becco Chem. Div.

Isotopes, Stable.....Company offers a revised stable isotopes inventory and price list. Complete details of the sales and loan policy are contained in the new Stable Isotopes Catalog. Catalog F-80001.
448K Union Carbide Nuclear Co.

Latices.....21 p. illustrated "Geon" Latex bulletin gives a general summary of the properties, compounding, handling and storage methods, and applications for Geon latices. Bulletin No. L-7.
448L B. F. Goodrich Chem. Co.

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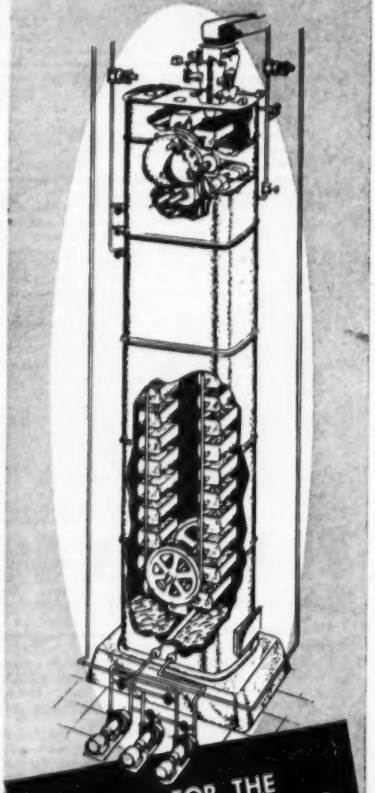

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LITERATURE . . .

Lithium Metal Dispersions.....Data Sheets describe methods for laboratory preparation of lithium metal dispersions in such dispersing mediums as mineral oil, petroleum and wax. Available on request.
284 *Lithium Corp. of America.

Molybdate Orange.....Laboratory data comparing the properties of molybdate orange & chrome orange. Includes results of test on lightfastness, hiding power, tinting strength, gloss & working properties. Bulletin Ch-22.
449A Climax Molybdenum Co.

Molybdenum Disulfide.....Bulletin covers three year experience with this solid film lubricant in the operation and maintenance department of the Baltimore and Ohio Railroad. Request copy of Bulletin Lu-4.
449B Climax Molybdenum Co.

Monomers.....Monomeric compounds are listed for easy reference. Gives simple properties, check list of applications, current production status, etc. Includes available and new research monomers. Bulletin F-8498-C.
449C Carbide & Carbon Chem.

Nitrogen Compounds, Aliphatic.....Illustrated 44 p. booklet describes many aliphatic nitrogen compounds, giving properties, specifications & test methods, etc. Includes physical property charts, shipping data, etc.
449D Carbide & Carbon Chem.

Nitroparaffins.....As solvents, the NP's present an unusual combination of properties. Request Technical Data Sheet for details, specifications, properties, uses, solubility tables, etc. plus product samples.
R377 *Commercial Solvents Corp.

Oils, Essential.....New 25 p. catalog listing essential oils, aromatic chemicals, perfume compounds, gums and perfume concentrates. Also includes balsams and sundries, oleoresins, and wick odors.
449E Orbis Products Corp.

Phosphates, Sodium.....Include: sodium tripolyphosphate, trisodium phosphate, tetrasodium pyrophosphate, sodium polyphos, sodium acid pyrophosphate, trisodium phosphate chlorinated, etc. Request catalog.
449F Blockson Chem. Co.

Polyethylene.....Offers new 14 p. brochure describing currently available grades of low molecular weight A-C Polyethylene. Gives actual and suggested end uses for these versatile polymers. Bulletin No. 116.
123 *Semet-Solvay Div.

Polyphenyl, Chlorinated.....Aroclor 1248 is a highly stable chlorinated polyphenyl; does not support combustion up to its boiling range 652° to 725° F.; is non-corrosive. Request technical information.
65 *Monsanto Chem. Co.

Polyvinyl Acetate.....“Elvacet” polyvinyl acetate coatings—either clear or pigmented—on paper, cloth, wall and floor coverings are easily applied and air dried. Company will furnish literature and information.
382e *E. I. du Pont de Nemours.

Polyvinyl Materials.....Products made from Geon rigid vinyl include corrosion-proof pipe, fume ducts, tanks, trays, materials that can be machined, planed, sawed, drilled, and cemented. Booklet on Geon 8700A & 8750.
12 *B. F. Goodrich Chem. Co.

Potash.....Dependable source of quality potash. Storage and shipping facilities planned to meet demand of peak fertilizer season. Provides service to help manufacturers with granulation and formulation. Details.
449G National Potash Co.

Potash, Caustic.....Company will send samples—solid, flake, small flake, liquid—along with book, “Caustic Potash and Potassium Carbonate.” Solvay's product is lowest in iron—lowest in turbidity.
149 *Solvay Process Div.

* From advertisement, this issue

NEW TYPE

ELECTRO-PERMANENT MAGNETIC

UNIT VIBRATOR

***introduced by* ERIEZ**

No other Unit (Bin) Vibrator like this! Eriez Magnetic “know-how” brings you the first complete line of Electro-PERMANENT Magnetic Unit Vibrators operating at 3600 CPM directly off an AC line. Just plug or wire them in.

NO RECTIFIER NEEDED

AND LOOK AT THESE ADDITIONAL HI-VI ADVANTAGES

Lower Maintenance and Operating Costs . . . Longer, Trouble-Free Service . . . Versatile Units Provide Broader Operating Ranges with Less Power Consumption . . . HI-VI units are Compact, Lightweight, Easily Installed, never need realigning . . . No Sliding or Rotating Parts to Wear, No Lubricants Needed . . . Noise Factor is reduced, working conditions improved . . . New type “Double Action” drive provides high operating efficiency with low operating cost . . .

ERIEZ HI-VI

UNIT BIN VIBRATOR

Don't bang that bin! An **Eriez HI-VI Unit Vibrator** keeps your bulk materials flowing freely and evenly through hoppers, bins and chutes. Prevents pile-ups, arching, bridging and sticking. Any product, in lump or powdered form, is kept moving freely in a steady stream by **HI-VI's** “Double Diaphragm” or kneading action. **Eriez HI-VI Unit Vibrators** work equally well on any hopper, bin or chute, any size or shape.

Eriez HI-VI Vibratory Feeder is offered also . . . it gives liquid-like flow to bulk materials for even, measured feed, variable from ounces to tons per hour. Same new, exclusive principle is back of its amazing money-saving performance in weighing, batching, proportioning operations.

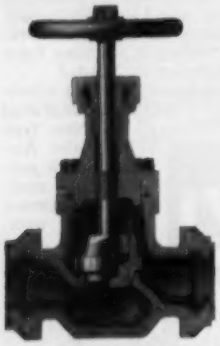
ERIEZ HI-POWR MAGNETIC SEPARATORS

These products are the latest developments of Eriez Manufacturing Co., world famous producer of permanent-powered Magnetic Separators.

For full information on new HI-VI Vibratory Equipment, write: Eriez Manufacturing Company, 74KV Magnet Dr., Erie, Pa.

FRICK Refrigeration

Serves Velsicol Chemical Corp. Three Ways



Frick Valves are Preferred for many high-pressure services: get catalog now.

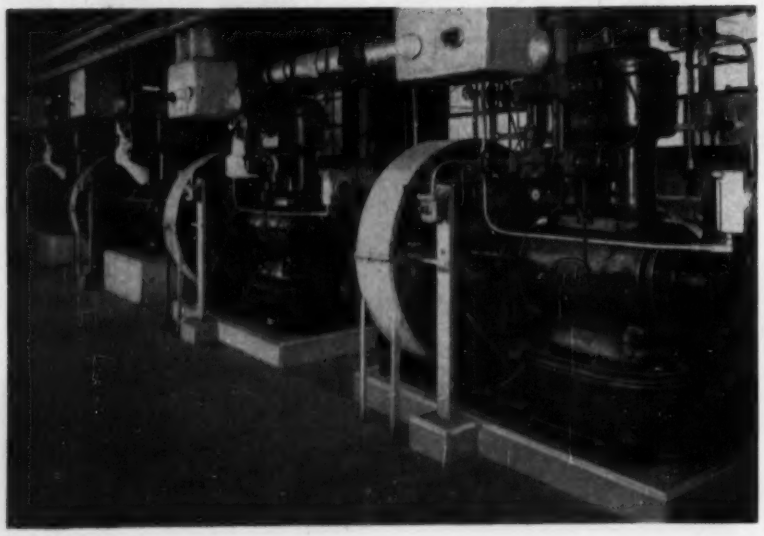
Below: Four of seven Frick compressors at Velsicol's Memphis plant.

At the Memphis plant of this important manufacturer of insecticides, Frick equipment performs these vital functions:

1. condenses chlorine gas to liquid form
2. cools water for chilling caustic
3. chills alcohols to 40 degrees below zero in an organic process.

Whether you need a cooling system for air conditioning, food service, ice making, quick freezing, chemical processes or any other commercial or industrial purpose, you'll find Frick ENGINEERED refrigeration the ultimate answer. Let us serve you as we now serve the biggest concerns in the world.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.



LITERATURE . . .

Propionaldehyde.....New technical bulletin includes information on physical properties, specifications, shipping data, applications, & toxicity. A number of typical reactions are also given. Bulletin F-40110.
450A Carbide & Carbon Chem.

Resins, Acrylic.....Lucite acrylic resins available with a wide range of molding characteristics & properties & in a variety of transparent, translucent & opaque colors. Offers descriptive literature on request.
89a *E. I. du Pont de Nemours.

Resins, Epoxy.....A new mailer, entitled "Why Plastic Tooling?" tells how tooling compounds based on Bakelite epoxy resins can cut production costs and simplify model changeovers. 39 applications listed.
450B Bakelite Co.

Resins, Nylon.....Zytel is the du Pont trade-mark for a versatile group of long-chain synthetic polymeric amides exhibiting extreme toughness & strength. Complete data on properties & applications on request.
89b *E. I. du Pont de Nemours.

Resins, Plastisol.....Exon 654 is expressly created to impart excellent heat and light stability, physical toughness and chemical stability to your products. Request full information on entire product line.
275 *Firestone Plastics Co.

Resins, Polyethylene.....Tough, flexible Alathon polyethylene resin stands up well against abrasive slurries. Widely used in industrial pipe applications. Offers complete information on the properties and applications.
89c *E. I. du Pont de Nemours.

Resins, Solution.....16 p. bulletin describes "Geon" solution resins, their compounding, preparation, and applications. Includes procedure for viscosity determinations, tables, etc. Service Bulletin G-15.
450C B. F. Goodrich Chem. Co.

Resins, Tetrafluoroethylene.....Teflon tetrafluoroethylene resins used extensively in process industries. Offer chemical inertness, high heat resistance, low-temperature toughness, etc. Properties & applications.
89d *E. I. du Pont de Nemours.

Soda, Caustic.....''Caustic Soda Buyer's Guide'' contains helpful facts on economics of 50% & 73% solutions; other forms of caustic soda; capacities of tank cars & other containers; useful shipping data; etc.
326b *Hooker Electrochem. Co.

Sodium Borate Perhydrate.....''Perdox'' sodium borate perhydrate makes for easy removal of coffee and tea stains —the worst offenders on plastic ware. Wil not affect the surface, or lose stain-removing ability. Request literature.
382b *E. I. du Pont de Nemours.

Sodium Dispersions.....Sodium dispersions were first developed by du Pont & are particularly useful in systems where sodium is insoluble. Request literature on sodium dispersions & how to use them to advantage.
382a *E. I. du Pont de Nemours.

Sodium Lignosulfonates.....New 7 p. bulletin describes the use of "Polyfon", sodium lignosulfonate as a low price, moderately active dispersant in wettable insecticide powders. Request Technical Bulletin No. 306.
450D Virginia Pulp & Paper Co.

Sodium m-Silicate.....Valuable data on Drymet anhydrous—the most highly concentrated form of sodium m-silicate. Drymet File Folder contains complete technical information and suggested formulations.
BR 467 *Cowles Chem. Co.

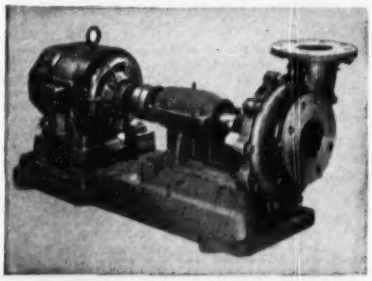
Sodium Sulfhydrate.....Hooker sodium sulfhydrate dissolves rapidly, even in cold water. There's virtually no sedimentation even after long standing. Available in 90-lb. & 350-lb. drums. Technical Data Sheet.
326e *Hooker Electrochem. Co.

* From advertisement, this issue

MOVING LIQUIDS?

YOU CAN DEPEND ON

Frederick



SSV PUMPS

for most efficient, carefree service!

CHECK THESE FEATURES

- Single stage, single end suction—with enclosed or open impeller.
- 1" to 4" discharge openings; heads up to 220 feet; operating speed—1750 rpm.
- One piece impellers, secured to shaft by key and lock nut, or threaded, give long service.
- Flanged suction and discharge openings mean easier connecting and disconnecting of joints.
- Vertically split pump casing and horizontally split bearing housing give maximum accessibility for maintenance.
- Extra large stuffing box, or mechanical seal—both provide minimum leakage.

Enclosed impeller types for chemicals, oils, juices, clear liquids, acids, etc. Open impeller types for slurries, brewery mash, food mash, white water, paper stock up to 2% consistency, etc. Constructed of metals to meet *your* requirements—cast iron, nickel, stainless steel, monel, etc. Send your requirements to our skilled staff for suggestions. Ask for free copy of Bulletin 107.

FREDERICK PUMPS

FREDERICK IRON AND STEEL, INC.

FREDERICK Est. 1890 MARYLAND

LITERATURE . . .

Sodium Sulfide.....The clean, strong flakes dissolve right into process, even without stirring. No waiting-no decanting. For complete information on Hooker's sodium sulfide, request Technical Data Sheet.
326d *Hooker Electrochem. Co.

Solvents.....These solvents are recommended for low odor and odorless products. Detailed specifications of these Shell Solvents are contained in the booklet, "Shell Solvents for Low Odor & Odorless Paints."
277 *Shell Oil Co.

Solvents.....Shell Chemical solvents meet or exceed industry's highest standards for purity and uniformity, at lower cost. For more complete information request quotations and specifications.
111 *Shell Chemical Corp.

Sulfoxide.....Sulfoxide is an effective synergist . . . safe . . . non-irritating. 12 p. bulletin, "Sulfoxide," gives technical information and suggested starting formulas for popular insecticidal spray. On request.
451A S. B. Penick & Co.

Surfactants, Nonionic.....Suggested uses for Teox 120 . . . textile cleaning and dye leveling, de-dusting, emulsifying agent and dispersant. Request data sheet, testing sample and bulletin on Teox 120.
451B Blockson Chem. Co.

Tetrahydrofuran.....Finds increasing use in applying top coats of high molecular weight polyvinyl chlorides to polyvinyl chloride sheeting and supported fabric. For complete information, request Technical Bulletin.
382e *E. I. du Pont de Nemours.

Thickeners.....Superloid is an efficient thickener for latex and resins. Produces desirable body and improves working properties. Effective for maintaining stability of dilute latex systems. Sample and bulletin.
451C Kelco Co.

Trimethylolpropane.....Another new aldol product from Celanese—in continuous large volume . . . with exceptionally high purity . . . at a new low cost. Makes available samples, prices and product information.
167 *Celanese Corp. of America.

Construction Materials

Aluminum.....New bulletin "Aluminum in Stock at Ryerson" is company's first publication covering its new stock of Reynolds aluminum. Included is information on aluminum plates, sheets, etc.
451D Joseph T. Ryerson & Son.

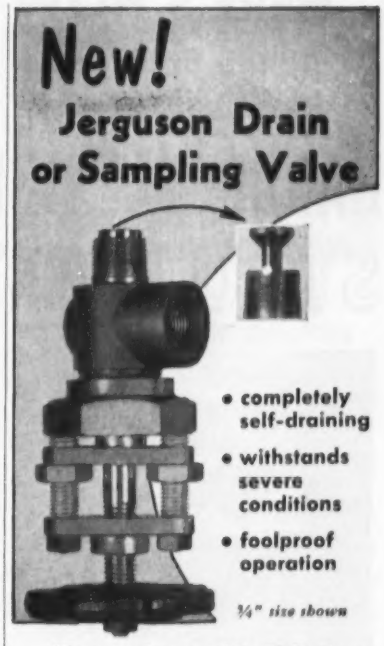
Bags, Film.....Bulletin describes film bags made of Bakelite polyethylene. Resists abrasion & tearing & tends to act as a resilient cushion protecting each unit from shipping shocks. Request Bulletin #9015.
451E Bakelite Co.

Castables, Insulating.....Alundum 23-I insulating castable mixes and pours like concrete . . . protects up to 3300°F. It is easy to install and to store. Company makes full particulars available upon request.
L465 *Norton Co.

Castings, High Alloy.....Covers facilities for producing high alloy static & centrifugal castings & offers data on castings used for resisting high temperatures, corrosive & abrasion. See Bulletin No. 3354-G.
448 *Duraloy Co.

Cements.....New 8 p. illustrated color folder describes Super #3000 Refractory Cement, a heavy duty brick bonding and patching mortar. Includes cases concerning product's application in high temperature work.
451F Refractory & Insulation Corp.

* From advertisement, this issue



The new Jerguson No. 23 Drain or Sampling Valve is completely self draining, for the valve stem seats on the outside of the valve body. It is ideal for installations where it is desirable to have the valve seat inside the wall of a vessel in order to prevent the typical condition of liquid remaining in the nipple and valve inlet.

This rugged, new Jerguson Valve has outside screw and yoke construction to meet high temperature or corrosive conditions where inside threads cannot be tolerated. The efficient outside thread design eliminates possible freezing and allows the valve stem to work freely at all times. The No. 23 Valve provides foolproof operation because the stem is constructed with a left-hand thread, thus allowing the valve handle to operate in the normal direction of standard valves.

Available in sizes from ¾" to 2" N.P.T. ¾" and 1" sizes are recommended for pressures of 4000 lbs. @ 100° F. and 1000 lbs. @ 750° F.; 1¼, 1½ and 2" sizes are recommended for 600 lbs. @ 100° F. and 250 lbs. @ 750° F. Optional features include construction with additional outlet for such uses as a steaming out connection and with a reamer on the end of the stem to break away encrusted matter which may have collected on the inside vessel wall.

Write for data unit and complete details.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY

100 Fellsway, Somerville 45, Mass.

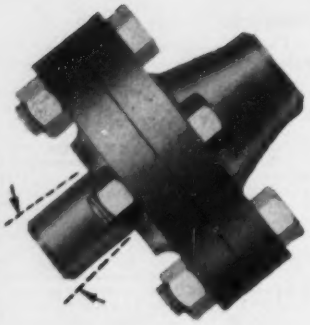
Offices in Major Cities

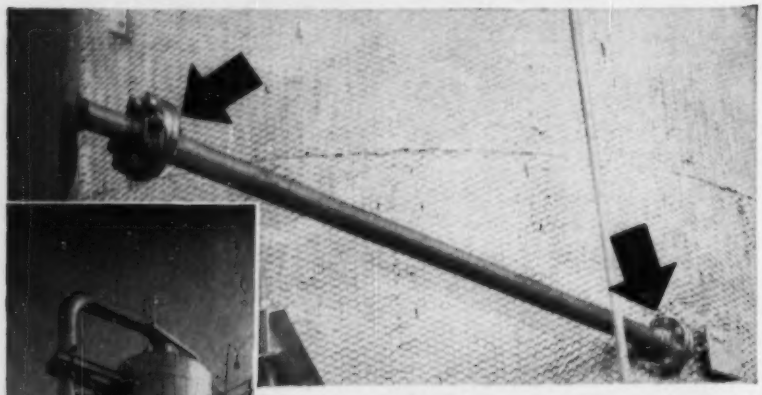
Jerguson Tress Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

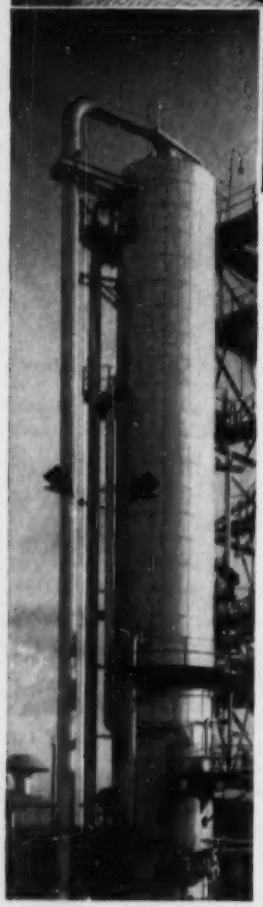
HERE'S HOW

Plant Engineers and Builders Use

BARCO FLEXIBLE STRUT JOINTS







—for Structural Applications

Barco Flexible Strut Joints are an important aid in chemical and petrochemical plant construction. A typical use is at the ends of struts for supporting or bracing large catalyst carrier lines or vent stacks on fluid catalytic crackers. Joints permit thermal expansion or contraction movement as required while maintaining axial (linear alignment) position. Other uses include guying tall vessels and columns and directing thermal movements of high temperature piping.

SIMPLE, VERSATILE!—The Barco Strut Joint is a dependable, compact, versatile fitting requiring practically no maintenance. It is a simple ball and socket that provides a point of flexibility. The close fit between ball and casing, allows for reversible loads, not possible with pin and clevis type braces. Barco Strut Joints support without restricting freedom of movement.

COMPLETE LINE—Available in following sizes and capacities: 1"—8,500 lbs., 1½"—14,500 lbs., 2"—20,000 lbs., 3"—40,000 lbs., 5"—80,000 lbs., 6"—120,000 lbs. Welding ends for field or shop use. Unique "Bar-Moly" treatment of wearing parts provides permanent dry lubrication for long service.

ENGINEERING SERVICE—Barco will be glad to work with your engineers in the selection of joints to meet your requirements. *Ask for new Catalog Sheet No. 229.*

SEND for your copy of interesting new illustrated bulletin No. 28 showing PETROCHEMICAL AND PETROLEUM INDUSTRY applications for Barco Ball, Swing, and Strut Joints.

BARCO *Manufacturing Co.*

5161 Hough Street • **Barrington, Illinois**

LITERATURE . . .

Cements, Insulating . . . . . Eagle-Picher One-Cote cement insulates, protects, finishes in one quick application. Cement is clean, easy to handle—provides a smooth, light-reflectant surface. Request free sample.
76 •Eagle-Picher Co.

Coating Systems, Protective. . . . . Ucilon coating systems give chemical engineers effective weapons against corrosion. Systems based on neoprene coatings for air dry or force dry application. Request data sheets.
306b •Metal & Thermit Corp.

Coatings, Protective. . . . . Illustrated Catalog describes Amercoat protective coating systems for corrosion control. Outlines corrosion control services: assistance in selection, help write specifications, etc.
241 •Amercoat Corp.

Coatings, Protective. . . . . Special characteristics, advantages and uses of "Water Base Adhesives & Protective Coatings for Industrial Insulations" are described in a new four page comprehensive folder.
452A Flintkote Co.

Coatings, Protective. . . . . Tygorust & Tygon "ATD" are companion products to make your fight against corrosion less costly—more effective. You can get better protection. For the full story see "Tygon Painting Manual."
102 •U. S. Stoneware Co.

Coatings, Protective. . . . . For any equipment or surface that can be uniformly baked . . . Plastisol compounds offer easy, economical way to apply long-lasting vinyl coating protection. Data in Bulletin No. VP-1.
306e •Metal & Thermit Corp.

Coatings, Resistant. . . . . 4 p., photo-illustrated bulletin describes latest development in sprayable plastisols, Unichrome "Super 5300" Plastisol Coating. Describes single spray application. Request Bulletin SP-1.
452B Metal & Thermit Corp.

Corrosion Proofing Materials. . . . . Wide range of corrosion-proof linings, bonding cements, bricks, flooring materials and protective coatings . . . can be used separately or in combination. Catalog G-201.
156 •Cellcote Co.

Enamels, Wire. . . . . New 12 p. technical bulletin on "Lecton" acrylic resin wire enamel describes the new magnet wire enamel in comparison with the standard wire enamels—polyvinyl formal & nylon.
452C E. I. duPont de Nemours & Co.

Fabrication, Metal. . . . . Booklet, "Facilities & Products," with information & photographs which show why company can turn out—at low cost—specialized heavy equipment for chemical plants, available on request.
152 •Newport News Shipbuilding.

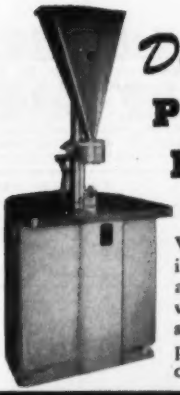
Fabrics. . . . . Illustrated 16 p. booklet on "Lantuck" explains the qualities and extensive uses of this versatile non-woven fabric. Design and features are fully described, as well as application and construction.
452D Wellington Sears Co.

Felts, Teflon. . . . . Company offers information describing Kelon-T impregnated Teflon Felt for use as seals or gaskets. Describes applications, availability, properties, etc., in product reference.
452E Shamban Engineering Co.

Insulation, Pipe. . . . . Amosite . . . the South African asbestos with long, strong, resilient fibers gives Unibestos pipe insulation greater strength and superior insulating ability. Information in Bulletin No. 109C.
280 •Union Asbestos & Rubber Co.

Latices. . . . . Company offers newsletter describing the effect of pH on the properties of textile resin finishes modified with Hycar Latex. Also describes washable Hycar top grain leather finish. Issue No. 13.
452F B. F. Goodrich Chem. Co.

• From advertisement, this issue



Dustless
POWDER FILLING

Vacuflow powder filling equipment operates on a principle of vacuum feeding, instead of pressure, to pack powder into a container.

VACUFLOW

Air is removed from the container to create a vacuum which draws a measured quantity of powder from the hopper. There is no problem with dust control, since the unique Vacuflow method simply does not involve air currents that cause dust.

Semi-automatic models are available for filling containers ranging from the tiny talcum box up to and including 100 lb. paper bags and 200 lb. drums. Rotary models are available for automatic production of 5 lb. sizes or less at speeds of 45 to 300 per minute.

Pneumatic is the one manufacturer in a position to furnish machines for making up complete production lines. Units are available for air cleaning, powder and liquid filling, capping and labeling a wide range of bottles, cans or jars.

PNEUMATIC SCALE CORP., LTD.,
85 Newport Ave., Quincy 71, Mass.
Also: New York; Chicago; Dallas; San Francisco; Los Angeles; Seattle; Leeds, England—Canadian Division; Delamere & Williams Company, Ltd., Toronto

PNEUMATIC

LITERATURE . . .

Linings, Drum.....Unichrome drum linings deliver resilient, seam-free, pore-free protection against such materials as acids, alkilies, salt solutions, alcohols, detergents, etc. Request descriptive Bulletin No. DL-2.
306a *Metal & Thermit Corp.

Materials of Construction.....Atlas offers technical advice, engineering and design assistance, highest quality corrosion proof materials and construction services. For complete details, request Bulletin CC#3.
366 *Atlas Mineral Prods. Co.

Metals.....Kennametal is available in many standard forms, in addition to special shapes and parts, such as: rectangular blanks, discs, rods, tubes, flats, balls, rings. For details, see Bulletin B-111.
444 *Kennametal Inc.

Metals, Talide.....A tungsten carbide of superior quantity, is harder, stronger, and more resistant to abrasion than any other metal. Superior where wear, heat and strain are destructive to other metals. Catalog 56-G.
84 *Metal Carbide Corp.

Plastics.....Booklet "Plastics in the Home Building Industry" tells the story of newest group of building materials that assure the builder of installation economies, lifetime performance, etc. No. 9101.
453A Bakelite Co.

Plastics.....For conquering corrosion in storage and process tanks, in fume removal, in chemical flooring, in process pipe and fittings, in columns, heat exchangers. Full details in Bulletins C-13 and G-10.
440 *Haveg Industries.

Plastics.....Many years of research and wide practical experience are behind American Agile in the fields of plastics and corrosion prevention. For detailed information, request your copy of Brochure AA-4.
L473 *American Agile Corp.

Process Equipment, Fabricated.....For your most efficient means to fast, economical production, for individualized equipment designed & constructed to fit your needs. Request your copy of Koven's Bulletin 550.
95 *L. O. Koven & Bro.

Rubber & Plastic Materials.....Piping, pumps, valves and tanks have a wide range of temperatures, pressure, impact resistance. For details about Ace rubber and plastic materials, request Technical Data CE-50.
385b *American Hard Rubber Co.

Rubber, Silicone.....Newly published brochure, "Silicone Rubber & Allied Products" is a first real attempt to remove silicone rubber products from the custom production category. Price list is available with brochure.
453B Connecticut Hard Rubber Co.

Sheet, Stainless.....Steel industry estimates that 50% of stainless sheet applications could employ type 430 as an economical and practical material. See, "Care & Use of 430 Micro-Rold Stainless Steel."
290 *Washington Steel Corp.

Steels, Stainless.....Essential information on composition, properties, fabricating methods and applications of AL chromium-manganese, low-nickel stainless steels. Request your copy of Technical Studies #3.
315 *Allegheny Ludlum Steel Corp.

Steels, Stainless.....Armco ELC Stainless Steel features low-cost, corrosion-safety factor. Two extra-low carbon stainless grades in sheets, strip, plates, bars and wire. Request "Armco's ELC Stainless Steels."
353 *Armco Steel Corp.

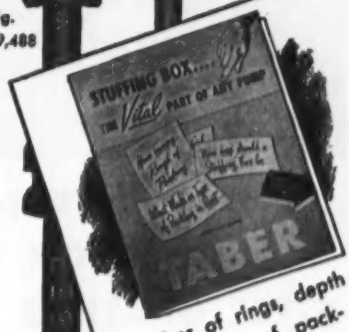
Titanium.....Shows resistance to chloride solutions and retains useful strength up to 800-1000F. Other advantages and data on application and fabrication of titanium alloys in descriptive Rem-Cru Review.
68 *Rem-Cru Titanium.

* From advertisement, this issue

PUMP STUFFING BOXES

INFORMATION suggesting solution of common stuffing box difficulties; available in newly revised BULLETIN S-147

Fig. 19,488



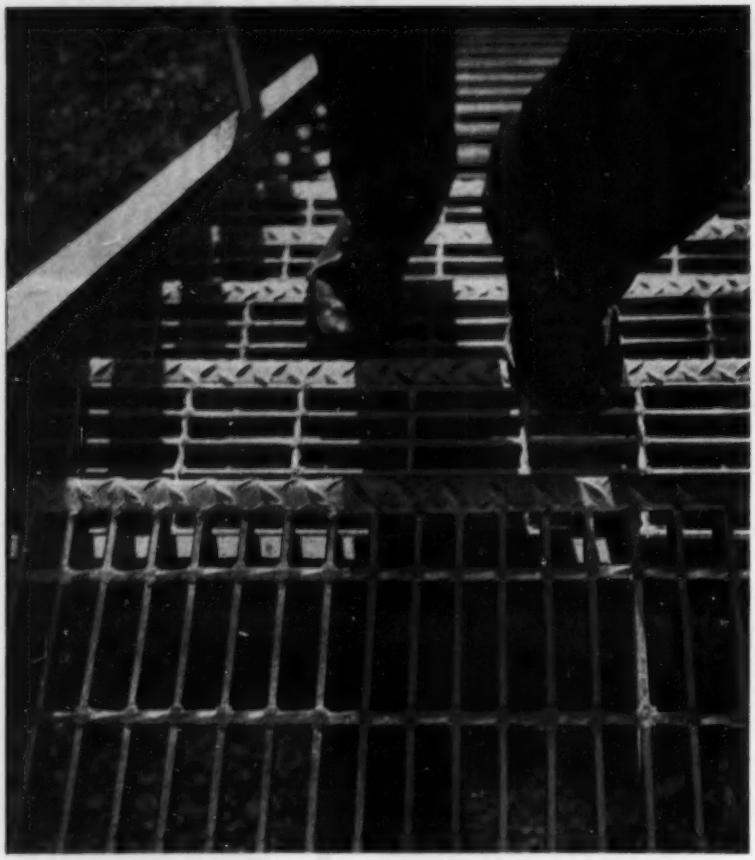
Number of rings, depth of box, type of packing . . . chemical and physical properties of the fluid being pumped, speed of shaft and other pertinent usable facts are in this Bulletin.

WRITE on business stationery for your copy of Bulletin S-147.

TABER PUMP CO. (Est. 1859)
294 ELM ST. • BUFFALO 3, N. Y.

Fig. 6041

TABER



... make every step a safe step

BLAW-KNOX ELECTROFORGED® STEEL GRATING and STAIR TREADS

On stair treads, walkways, catwalks, platforms and floors—both indoors and outdoors—you can provide safe walking conditions. For Blaw-Knox Electroforged Steel Grating brings you these exclusive features:

1. rigid one-piece construction—easy to install
2. non-slip twisted crossbar—for safe footing
3. three types of bearing bars
   - square bars—for smoothest walking surface
   - knurled bars (Furro-Grip)—for extra safety plus relatively smooth walking surface
   - serrated bars—for maximum safety under extremely hazardous skid conditions
4. no sharp corners to clog—self-cleaning
5. all surfaces accessible—easy to paint
6. maximum open area—for light and ventilation

Write for your copy of new Bulletin No. 2486 —or send dimensional sketch for quotation.

50th Anniversary BLAW-KNOX 1906-1956

BLAW-KNOX COMPANY

BLAW-KNOX EQUIPMENT DIVISION

Pittsburgh 38, Pennsylvania

GRATING APPLICATIONS: floors • platforms • walkways • catwalks • stair treads • fan guards • shelving • and many other uses, both outdoors and indoors, for versatile steel grating

LITERATURE . . .

Tubes & Rods, Plastic.....New 24 p. 2-color catalog on plastic rod & tube stock covers available sizes & prices of stock made of methyl methacrylate, Teflon, cast acrylic, vinyl, polyethylene, cellulose acetate & polystyrene.
454A Friedrich & Dimmock.

Coatings, Protective.....Roofkoter can be applied cold by unskilled labor . . . stays flexible . . . expands and contracts with temperature changes. Won't blister, crack or powder. "Saving Old Roofs."
454B Tropical Paint Co.

Electrical & Mechanical

Cables, Armor.....New booklet covers interlocked armor cable that is designed specifically for primary & secondary feeders in industrial power distribution systems & for generator leads, etc. Bulletin 19-555.
454C General Electric Co.

Cleaning Tools.....News release describes super-jet condenser cleaning tool that provides extremely fast & effective cleaning of condenser tubes. Includes 3 types of slugs in sizes to fit all standard tubes.
454D Crane Packing Co.

Cores, Magnetic.....Bulletin describes Ferramic Magnetic Cores, giving specifications & data on standard grades of Ferramic "S-1". Includes tables of core sizes & magnetic properties. Bulletin MT-103.
454E General Ceramics Corp.

Drives.....New 2 p. illustrated two-color bulletin describes new Size 125 Type T Gyrol Fluid Drive for general industrial application. Discusses construction features of design & outlines advantages. Bulletin 9719.
454F American Blower Corp.

Drives, Fluid.....New 8 p. illustrated two-color catalog describes the new 1 through 25 hp Type VS Class 2 Gyrol Fluid Drives. Discusses advantages and typical applications. Request Bulletin 9819.
454G American Blower Corp.

Drives, Speed.....Makes available literature describing Century's Selective Speed Drives . . . 1 to 150 hp. Offers a wide range of closely controlled speeds. Request your copy of Bulletin No. 11-1P1.
319a *Century Elec. Co.

Drives, Variable Speed.....Company offers information on new line of variable speed drives, Vari-Mount. Feature standard, interchangeable components & designed to accommodate standard motors.
454H Foote Bros. Gear & Mach.

Expanders, Tube.....New 119 p. catalog contains detailed information about tube expanders & associated tools used for tool rolling, methods, tool maintenance, expansion calculations & charts, etc. Catalog No. 88.
454I Thomas C. Wilson.

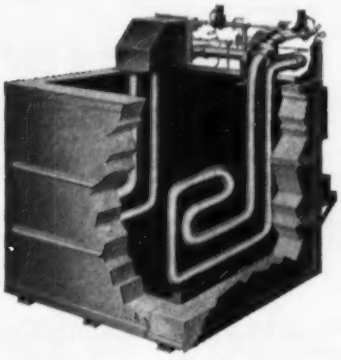
Gaskets, Teflon.....The ideal seal for many process applications is a Flexitallic gasket with teflon trapped between edges of stainless steel. For complete data request folder, "Teflon in Flexitallic Gaskets."
362 *Flexitallic Gasket Co.

Motors.....Data Book shows how & why the New Standard, smaller motors actually outperform the larger, heavier ones. Weight savings to 40% plus space savings. Request Bulletin No. 6-1P1.
319b *Century Elec. Co.

Motors.....L. A. enclosed and explosion-proof motors feature: split conduit box, inner bearing cartridges, non-sparking fan, cast-iron end bracket and housing, prewound stator, locked bearings. See Bulletin 1700.
338 *Louis Allis Co.

* From advertisement, this issue

GET THE MOST HEAT TRANSFER



PER FUEL DOLLAR

Your fuel dollar buys more effective heat transfer with 'Surface' immersion heating than with other methods of heating liquids and salts.

Diffusion combustion and the heating tube immersed completely in the liquid put the heat where you want it, instead of out in the plant or up the stack. At the same time, gas firing gives you considerable savings over electricity at most temperatures.

A temperature range of 100°F to 1200°F is available in 'Surface' immersion heating. Tube design and materials can meet your specifications. Safeguards are readily applied to all 'Surface' immersion heating units.

Write for Bulletin SC-156.

Surface Combustion Corporation,
2367 Dorr St., Toledo 1, Ohio

Surface
HEATING EQUIPMENT

SURFACE COMBUSTION

Also makers of Janitrol® automatic space heating and Kathabar® humidity conditioning

LITERATURE . . .

Motors.....Company offers information on new line of motorized reducers called Line-O-Motor, combining the advantages of integral motor-reducer units with the versatility of separately mounted motors.
455A Foote Bros. Gear & Mach.

Motors.....New Elliott C-W type N motors are designed for the utmost in dependability. They will withstand physical abuse. For complete information on performance and features, request new Motor Bulletin.
159 *Elliott Co.

Motors.....Describes newly designed standard & explosion-proof enclosed motors, featuring corrosion-resistant cast iron frames, improved winding insulation & heavy duty ball bearings. Bulletin No. MU-203 & MU-132.
74 *Wagner Elec. Corp.

Motors, Drip-Proof.....For full operating efficiency choose a Century Motor—"Performance-Rated" to bring out all the top performance that's engineered into your equipment. Full details in Bulletin No. 1-5P1.
319c *Century Elec. Co.

Motors, Explosion-Proof.....Complete information on line of explosion-proof motors: 2 to 100 hp. UL approval Class I, "C" and "D"—Class II, "E", "F" and "G." Request your copy of Bulletin 6-1P45.
319d *Century Elec. Co.

Motors, Gear.....Furnishes information on line of Gear Motors—1 to 125 hp (parallel); ¼ to 3 hp (right angle or parallel); A.C. or D.C., speed to fit your need. Complete details contained in Bulletin No. 4-1P31.
319e *Century Elec. Co.

Packings, Asbestos Sheet.....Features Klinger's compressed asbestos sheet packing . . . for every purpose. Makes available the Klinger Master Catalog which describes the complete range of products.
251 *Klinger Corp. of America.

Rings, Teflon.....C-V Rings will effectively handle all industrial acids, alkalis, solvents, organic and hydraulic fluids . . . temperatures from −120° F. to +500°F. Complete details furnished in Bulletin T-110.
369 *Crane Packing Co.

Seals, Mechanical.....Combining chemically impervious teflon with a balanced bellows design—Chemiseal external mechanical seals last longer & give unsurpassed performance. Details in Bulletin No. MS-1155.
393 *U. S. Gasket Co.

Seals, Mechanical, Rotary.....Company announces the availability of an 8 p. reference which shows how you get maintenance-free sealing that slashes fluid mixing cost to a new low. See illustrated Bulletin B-111.
215f *Mixing Equipment Co.

Seals, Selector.....The new Sealol Flexibox Sealector enables you to decide on seal type size and materials for your specific requirements. Covers 48 typical products handled in the process industries. Request Sealector.
L459 *Sealol Corp.

Sheaves.....Illustrated catalog presents the complete line of Maurey Ful-Grip Q-D Sheaves, standard Multi-V Sheaves, & special made-to-order sheaves. Gives handling information, dimensions, etc. Catalog MVD-56.
455B Maurey Mfg. Corp.

Timers.....Bulletin describes the new Cramer Interval Timers, featuring high-torque motors and wide timing range, designed for commercial, industrial, process control, and laboratory use.
455C Cramer Controls Corp.

Transformers.....Varicell . . . a source of stabilized-regulated adjustable DC voltage from AC lines . . . is easy to operate. Bulletin covers purpose, provisions, and operation. Details in Bulletin V1051.
455D Superior Elec. Co.

* From advertisement, this issue

Strahman
RAM TYPE
Drain Valves

The Only Drain Valve That Cannot Clog Up!

In the closed position the piston or ram extends up into the tank, preventing plugging of the outlet.

In the open position with piston fully retracted, there is no resistance to flow of materials drained from the tank.

Made in any cast metal to meet your requirements.

Designed for bolting to existing flanges. For special adaptations and for jacketed vessels, adaptor pads are available.

Full Specifications on Application

STRAHMAN VALVES, INC.
16 Hudson Street
New York 13, U. S. A.

Only CEILCOTE OFFERS THIS COMPLETE CORROSION PROOFING SERVICE!

Tank linings

Drain trenches

Floors and walls

Pump bases

Write to CEILCOTE today . . . ask for Catalog G-201 . . . and get complete information of materials and services.

Fiberglas reinforced

Polycor ducts and hoods

● Regardless of the type of chemical attack that is costing you money and valuable time . . . CEILCOTE is prepared to supply materials and coatings that end your troubles.

CEILCOTE offers more than 30 years of unmatched experience and know-how. In addition . . . CEILCOTE engineers have developed a wide range of corrosion-proof linings, bonding cements, bricks, flooring materials and protective coatings . . . materials that can be used separately or in combination . . . materials that will lick your corrosion problems.

CEILCOTE engineers are prepared to evaluate and solve your corrosion problems. They are prepared to recommend materials required as well as supervise or handle in entirety your complete installation.

7139-CC

THE CEILCOTE CO., Inc.

4836 RIDGE ROAD • CLEVELAND 9, OHIO

LITERATURE . . .

Transmission Equipment.....12 p. technical brochure describes complete line of power transmission equipment, including flexible couplings, variable speed pulleys, universal joints and motor bases.
L461 Lovejoy Flexible Coupling.

Turbines, Gas.....The new Clark Mark TA 1130 bhp gas turbine is the most modern, compact and efficient power plant combination you can install. For complete information on Clark turbines, request Bulletin No. 142.
264-5 *Clark Bros. Co.

Turbines, High-Speed.....Well-designed, efficient seals . . . cut steam leakage . . . reduce maintenance costs of G-E High-speed Turbines. Also feature low-cost, easily-replaced carbon packings. Bulletin GEA-6232.
137 *General Elec. Co.

Turbines, Steam.....Turbines range from 150 horsepower down to fractional in 6 frame sizes. Feature large number of manually operated valves for individual control of steam nozzles. Details in Bulletin 135.
99 *Coppus Engrg. Corp.

Handling & Packaging

Bins, Storage.....New bulletin describes the Day Horizontal Storage Bin designed for buildings with limited headroom. Describes availability, build, construction features, etc. Bulletin 549.
456A Day Co.

Boxes.....Carboy boxes are quality built to meet ICC regulations. Features give all-point protection . . . reducing hazards and breakage, ease in handling, compact loading. Complete data available on request.
456B Treen Box Co.

Conveyors.....Raising and lowering loaded pallets from one floor level to another is quick, safe . . . and automatically accomplished with an Alvey conveyor. For description of operation of system, see Booklet 130.
379 *Alvey Conveyor Mfg. Co.

Conveyors, Belt.....Bulletin describes a new exclusive hydraulic adjusting control, a new feature of Speedways conveyors "Speedlift" portable power belt conveyor. Also describes the operation.
456C Speedway Conveyors.

Conveyors, Belt.....New bulletin describes the Rapistan Stevedore, Jr., a portable inclined belt conveyor. Illustrates & describes the units application to loading, unloading, movement of materials, etc. Form 200-56.
456D Rapids-Standard Co.

Conveyors, Screw.....Link-Belt's sound engineering and quality manufacture assure you of top performance. A 92-page Screw Conveyor Book contains complete ordering data. Request your copy. Book No. 2289.
13 *Link-Belt Co.

Feeders, Wet Reagent.....Accurately meter minute quantities of liquid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of feeder to bulk storage device. Data in Bulletin F6-B9.
388e *Denver Equipment Co.

Idlers.....New 4 p. three-color bulletin describes company's line of deep trough belt conveyor idlers. Designed for handling all sorts of lightweight bulk materials including cereals & other grains, etc. Bulletin 76.
456E Barber-Greene Co

Magnets....."Magnetic Ideas From Eriez" contains case histories explaining how various firms use permanent, non-electric magnets to prevent iron contamination in their products. Illustrated, 24 p. Brochure B-213.
456F Eriez Mfg. Co.

* From advertisement, this issue

The Alnor Dewpointer takes the guesswork out of dew point readings... makes it easy, even for non-technical personnel, to achieve consistent accuracy. That's because fog is suspended in an enclosed chamber, under controlled conditions which can be reproduced time after time... anywhere. This means faster readings, too, with no time lost calculating variables. And the Alnor Dewpointer is completely self-contained, requires no external coolant or auxiliary apparatus. It operates on either a.c. or the enclosed battery. Available in three ranges... for dew points between – 20°F. and room temperature, from – 80°F. to – 0°F. and from – 80°F. to room temperature. For more information, send for your copy of the Alnor Dewpointer Bulletin. Illinois Testing Laboratories, Inc., Room 559, 420 North La Salle Street, Chicago 10, Illinois.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

LITERATURE . . .

Materials, Handling.....Company offers a 41 p. directory of their standard products, engineered equipment, & manufacturing sales, & service facilities. Includes research facilities, technical literature, etc. Book 2653.
457A Link-Belt Co.

Scales.....Toledo's new Scale Check Chart will show you quickly and accurately how well your scales are serving you, and provide the information you need for effective cost control. Chart is available on request.
458 *Toledo Scale Co.

Scales, Bagging.....Company offers information on new Multi-Purpose Bagging Scale, a new power-driven belt-fed bagging scale sacking 25-, 50-, & 100-lb. bags at rates up to 15 bags a minute.
457B Richardson Scale Co.

Side Shifters.....Bulletin describes the operation and specifications of a new side shifter attachment which is available for the complete line of stand-up & sit-down industrial trucks.
457C Lamson Mobilift Corp.

Sodium Handling, Metallic.....Illustrated, 44 p. brochure, "Handling Metallic Sodium On A Plant Scale," contains data such as details of typical sodium-using processes; details of equipment installation, insulation, etc.
243 *U. S. Industrial Chem. Co.

Towboats.....Described in a new 4 p. illustrated folder is the Dravo RAM-class 70-foot diesel powered towboat used in a variety of inland waterways operations. "The Dravo RAM Towboat" Bulletin No. 250-128.
457D Dravo Corp.

Trailers, Industrial.....Offer new 2 p. two-color bulletin describing & giving full specifications for Models A-610 & A-660, fifth wheel steer trailers of 4000 & 6000 lb. capacity, respectively. Bulletin TR-101.
457E Mercury Mfg. Co.

Trucks, Fork.....Baker "FG" gas trucks feature: heavy-duty industrial truck engine operates at optimum RPM for least strain and abuse; pistons are balanced to grams instead of ounces. Request bulletins.
457F Baker-Raulang Co.

Trucks, Fork Lift.....Attractive pocket-sized Operator's Manual covers subjects of interest to owners & operators of Towmotor Fork Lift Trucks. Covers operating instructions, specifications, maintenance procedures, etc.
457G Towmotor Corp.

Trucks, Fork Lift.....Illustrated bulletin gives the standard specifications for Towmotor fork lift trucks. Also includes specifications for Towmotor industrial tractors and electric pallet trucks.
457H Towmotor Corp.

Trucks, Lift.....Offer 2 drive wheels, 2 braking systems, 4 wheel stability, alloy gear transmission, 100% more steering ease, 50% less maintenance, finger-tip control affording greater safety. Catalog No. 65.
457I Lift Trucks

* From advertisement, this issue

Keeping too busy?

You'll find our streamlined Reader Service section right up your alley. It's designed for busy engineers who want to find things fast, get more information fast. RS is easy to use, and you can bank on it.

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makes simple work of Filtering, Mixing, Storing

Regardless of the size or type of your installation, whatever your process may be, there's an Aslop Filter, Mixer, and Storage and Mixing Tank to "fit your job". You can be sure of getting from Alsop the right unit properly applied—you can depend on Alsop proved performance features. Alsop Filters, Mixers, and Tanks are available in a complete range of sizes and capacities, and Alsop Equipment is custom fitted to your application by engineers who have thorough experience in Filtration and Agitation. For full information, recommendations and quotations write Alsop Engineering Corporation, 1104 White Road, Milldale, Connecticut.

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innovation in lab hoods*

Saves 1/2 Ton

Refrigerating Capacity Per Hood

Uniquely efficient in performance, the radically new Fume Hood manufactured by Kirk & Blum reduces by one-half the loss of cool air in an air-conditioned laboratory . . . as well as offering new modern convenience to the chemist.

Fume control and air flow characteristics are greatly improved over standard types. Initial costs are moderate and servicing simple.

Fabricated to the design and specifications of a leading manufacturer of soaps and detergents, the new hood typifies Kirk & Blum's 50 years' experience in fabricating equipment for the chemical industry. Fabrication in steel, copper, aluminum, monel, stainless and other alloys is a Kirk & Blum specialty.

Write for details, or send drawings for prompt quotation.

- Epon-phenolic coating on sheet metal resists action of acid and alkali fumes.
- Separate supply and exhaust plenums deliver outside air, remove fumes.
- 3' x 4' reinforced safety glass door counter-balanced for ease of access.
- Visibility increased by built-in interior fluorescent illumination.
- Turbulence free atmosphere for controlled experiments.

* PAT. APPLIED FOR

KIRK & BLUM

FABRICATION FOR CHEMICAL INDUSTRIES

THE KIRK & BLUM MFG. CO.

3208 FORRER ST.
CINCINNATI 9, OHIO

LITERATURE . . .

Utilizers.....New Standard Utilizer assembles and builds unit-loads in desired shape and size . . . automatically . . . directly from conveyor line. Expedites production while cutting handling costs. See Bulletin 0-10.
468 *Standard Conveyor Co.

Vibratory Equipment.....Electro-permanent magnetic Hi-Vi vibratory equipment needs no rectifier. Operates at 3600 CPM directly off an AC line. Units are automatically self-adjusted. Request data.
458A Eriez Mfg. Co.

Heating & Cooling

Air Handling Equipment.....Company offers information on a new line of air handling combination units for general application including ventilating, heating, & air conditioning. Units available in 13 basic sizes.
458B Westinghouse Electric Corp.

Chambers, Temperature Control.....Attractive 4 p. folder discusses the Tenney TR Chamber especially designed for accurate controlled low-high temperature and relative humidity testing.
458C Tenney Engineering

Coolers, Cascade.....Designed for cooling corrosive liquids and gases. Low initial cost and maintenance, radiused returns for low pressure drop as well as redwood waterguide strips. Catalog Section No. S-6820.
237b *National Carbon Co.

Evaporation.....“An Open Door” shows how Swenson Engineering assists in solving many evaporation, crystallization, filtration, pulp washing and spray drying problems. Request your copy of illustrated, 12 p. Brochure.
44-5 *Swenson Evaporator Co.

Furnaces.....New 4 p. two-color bulletin fully describes the complete line of Lindberg Hydryzing Furnaces for hardening high carbon & high speed tools without scale, decarb or carburization. Bulletin No. 97-HS.
458D Lindberg Engineering Co.

Generators, Steam.....Describe the pre-engineered, standardized steam generators offered in 9 sizes, with capacities of from 50,000 to 150,000 lb. per hr. Includes drawings & design features. Bulletin B-55-4.
291 *Foster Wheeler Co.

Heat Exchangers.....Covers complete line of Karbate brand impervious graphite shell & tube heat exchangers. Engineered for maximum corrosion resistance & minimum maintenance. Catalog Section No. S-6840.
237d *National Carbon Co.

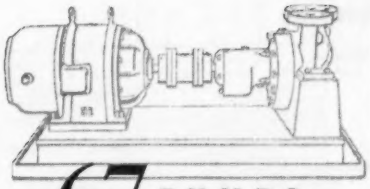
Heat Exchangers.....Describes how equipment offers: chemical resistance to practically all corrosive fluids; resistance to severe thermal shock; high heat-transfer rates; low maintenance; etc. Catalog S-6740.
237e *National Carbon Co.

Heat Exchangers.....The patented Ell Bolt construction employed on Vogt floating head heat exchangers is the answer to reassembly without distortion or leak development. Request Bulletin No. HE-6.
217 *Henry Vogt Mach. Co.

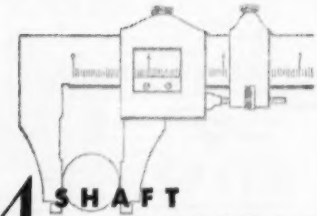
Heat Exchangers.....New bulletin describes a new, corrosion-resistant Graphite Heat Exchanger. “Polybloc” features design that eliminates cemented joints and produces continuous turbulence. Bulletin 6550.
458E Carbone Corp.

Heat Exchangers.....Describes Type “SSF” stainless steel heat exchangers for heating or cooling liquids & gases as used in industries where elements of corrosion to alloys are encountered. Catalog No. 1155.
474 *Young Radiator Co.

* From advertisement, this issue



67 PUMPS=



14 SHAFT DIAMETERS=

4 SEALS

SEALOL FLEXIBOX BALANCED SEALS REDUCE INVENTORIES

4 TO 1!

- A recent refinery survey revealed that 67 pumps involving *14* shaft diameters required only four sizes of SEALOL Flexibox Balanced Pressure Seals.

THIS MEANS:

Fewer parts for 100% protection. Maintenance and stocking procedures simplified by minimum parts handling.

- SEALOL Flexibox Balanced Seals come in only twenty-one standard sizes to fit all shafts with diameters from ¾" to 4¼". Teflon ® or O ring equipped seal components are dimensionally interchangeable.
- Send for your SEALOL Sealector which will enable you to properly survey your own operation!!

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SEALOL

THE BALANCED PRESSURE SEAL

LITERATURE . . .

Heat Exchangers, Cascade.....Specially constructed low-pressure-drop ells. Tubing extruded by improved method which results in more uniform heat transfer characteristics. Full details available upon request.
460e *Falls Industries.

Heat Exchangers, Cross-Bore.....Features a rugged, heavy-duty, one-piece bundle. Cross-Bore exchangers are furnished in standard, single and multipass models. Company makes further information available.
460d *Falls Industries.

Heat Exchangers, Cubical.....Provide maximum transfer surface in minimum space. Design accommodates operating pressures in the 150 psi range. Company makes further information available on request.
460b *Falls Industries.

Heat Exchangers, Impervious Graphite.....Accommodates operating pressures in 150-200 psi range; simple design results in good resistance to physical shock; easy shell side cleaning. Details in Bulletin No. 537.
460a *Falls Industries.

Heat Exchangers, Tube & Shell.....All normal tube and shell design features are available as standard. Custom designs are furnished on order. Company makes further information available on request.
460c *Falls Industries.

Heat Transfer Systems.....Capacities can range from small portable units to large gas- or oil-fired units generating from 250,000 to over 10,000,000 B.T.U.'s per hour. Request names of designers & manufacturers.
65 *Monsanto Chem. Co.

Heaters.....Company offers bulletin describing their Horizontal Unit Heaters, giving proven features, specifications, basic steam ratings, & hot water ratings, conversion factors, etc. Catalog No. 322.
459A McQuay, Inc.

Heaters, Circulation.....New 8 p. bulletin describes Chromalox automatic electric circulation heaters, for controlled heating of water, oils, heat transfer media, steam, air and other gases. Request Bulletin 701.
459B Edwin L. Wiegand Co.

Heaters, Electric Cartridge.....Bulletin describes Chromalox electric cartridge heaters of a style and size for every spot heating job. Describes special features that give positive lead wire protection. Bulletin 850.
459C Edwin L. Wiegand Co.

Heaters, Electric Strip.....Chromalox Electric Strip Heaters provide uniform, precise heat to fit the size and shape of your production equipment. For full information, request a copy of Bulletin No. F1566.
166 *Edwin L. Wiegand Co.

Heaters, Far-Infrared.....Illustrated bulletin describes advantages of Chromalox electric radiant heaters, their design, and variety of applications. Includes specifications, controls & prices. Bulletin CS604C.
459D Edwin L. Wiegand Co.

Heaters, Gradiation.....Makes available detailed literature—"Try the Gradiation Heater for Economical Ethylene Production" and bulletin. "Gradiation Heating for Petroleum and Chemical Processing."
340 *Selas Corp. of America.

Heating Units.....'How to Solve Winter Problems With Electric Heat" tells how to prevent condensation, melt snow & ice, heat rooms, provide hot water for the All-Electric Building. Bulletin F1575.
459E Edwin L. Wiegand Co.

Heating Units, Immersion.....Your fuel dollar buys more effective heat transfer with "Surface" immersion heating than with other methods of heating liquids and salts. Details contained in Bulletin SC-156.
L455 *Surface Combustion Corp.

* From advertisement, this issue

CHEMPRO

Teflon-Impregnated Asbestos PACKINGS

Chempro Teflon impregnated asbestos packings provide the chemical resistance of Teflon and at the same time have the strength and resilience of asbestos. They are far superior to conventional lubricated asbestos packings, since the Teflon gives protection from chemical attack to the asbestos.

CHEMPRO STYLE 500 PACKING is designed for pumps and equipment handling hydrocarbons, light solvents and other volatile products. *Do not use on acid or strong caustics.* It is composed of 85% white asbestos yarn square plaited and thoroughly impregnated with Teflon.

CHEMPRO STYLE 600 PACKING is designed for applications handling acids, strong caustics and other corrosives. It is made of 100% Blue Cape asbestos, square plaited and thoroughly impregnated with Teflon.

Chempro Teflon impregnated asbestos packings are available in standard sizes from ⅛" up to 1¼", by 1/16", either on spools by the pound or in die molded or mandril cut rings or ring sets.

Ordering Information for Rings and Ring Sets

1. Give shaft diameter and stuffing box bore and depth.
2. Number of rings required.
3. For standard equipment, specify make and serial number.
4. State if seal cage is used.

THE ORIGINAL FABRICATORS OF TEFLON PACKINGS AND GASKETS

*duPont Trademark

CHEMICAL & POWER PRODUCTS, Inc.

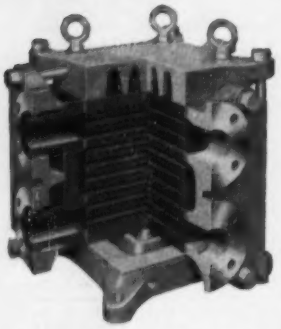
5 Broadway, New York 4, N.Y.

ONLY *Impervite*

Gives You All Basic Designs Of IMPERVIOUS GRAPHITE HEAT EXCHANGERS

CUBICAL

Provides greatest amount of transfer surface possible for size of exchanger. (Example: Model 4 can provide 50 sq. ft. on one side and 90 on the other). This IMPERVITE exchanger can be operated up to 150 psi, 340° F. They can be easily modified to permit change of application, and special interconnectors allow economical use of banks of CUBICAL exchangers.



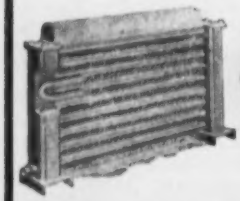
TUBE AND SHELL

You can get quick shipment on famous standard IMPERVITE tube and shell exchangers in sizes from 7 to 650 tubes, 9 and 12 ft. in length. In addition, flexible design and production facilities at Falls Industries enables custom units to be fabricated quickly and economically for practically any application.

Design of these exchangers is such that corrosives only come into contact with IMPERVITE impervious graphite. This material is unaffected by the action of all corrosives except a few highly oxidizing agents, is immune to effects of thermal shock, and possesses an exceptionally high rate of thermal conductivity. An extensive variety of standard and special IMPERVITE processing equipment is available from Falls Industries for long-life, corrosion-free service.

CROSSBORE

This new exchanger design is an exclusive Falls' development, which incorporates a "one-piece" bundle. It withstands operating pressures in the 150-200 psi range, resists greater physical shock, and is exceptionally easy to clean. Extreme simplicity of design provides truly maintenance-free operation.



CASCADE

All models utilize specially constructed low-pressure-drop ells. All tubing is extruded by an improved method which practically eliminates spalling at high temperatures and results in more uniform heat transfer characteristics.

WRITE FOR CATALOGS

Falls Industries Inc.

31915 AURORA ROAD • SOLON, OHIO

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LITERATURE . . .

Ovens.....Company offers illustrated bulletin describing laboratory and production ovens. Includes ratings, accessory information, features, diagrams, applications and specifications. Bulletin No. 100.
460A Despatch Oven Co.

Tandem Combustion Units, Oil-Gas..... You will realize higher profits from your heaters when National Airoil vertical or horizontal tandem units are specified. For full details, request Bulletin 498.
L468 *National Airoil Burner Co.

Thermo-Panels... ..Cost less & perform better—an improvement on pipe coils. You save space & heat or cool more efficiently. For use in heating & cooling of liquids, slurries, soaps, etc. Bulletin 355 & 256.
TL471 *Thermal-Panel Div.

Towers, Cooling.....Special features: superior shaft seals, heavier bearings, more conservative horsepower ratings, more rigid housing & more positive lubrication. Request copy of Pritchard Cooling Tower brochure.
L377 *J. F. Pritchard & Co.

Traps, Steam.....Request No. 1, 1956 issue of Armstrong Trap Magazine, together with copy of Armstrong Steam Trap Book containing data on traps plus selection, installation and maintenance recommendations.
311 *Armstrong Machine Wks.

Traps, Steam.....Give faster, more effective condensate removal. Powerful valve action, positive shut-off, high capacity & each unit service tested. For more details, request new Bulletin No. 10-55.
276 *W. H. Nicholson & Co.

Traps, Steam.....Yarway Impulse Steam Traps feature: small size-lightweight; only one moving part; stainless steel; won't freeze up. For complete information, request Trap Selector, Bulletin and Diagram.
309 *Yarnall-Waring Co.

Vaporizers.....Convert liquid chlorine to dry vapor . . . fast and economically. Available in five standard sizes with ratings from 500 to 8000 pounds per hour. For complete information, request Bulletin No. 132B.
62a *Whitlock Mfg. Co.

Instruments & Controls

Calibration Consoles, Thermocouple..... Complete equipment package designed for industries requiring frequent calibrations to maintain temperature measuring accuracy. Complete details in engineering data EDS-23.
472b *Thermo Electric Co.

Chromagraph.....Bulletin describes a new instrument for analysis of gases, liquefied gases & liquids by adsorption as well as by gas-liquid partition techniques. Apparatus is completely illustrated.
460B Hallikainen Instruments

Computers.....New G-15D Computer and its optional DDA accessory, working together, and supported by a full complement of input-output equipment, provide the best means of solution. Request new brochure.
299 *Bendix Aviation Corp.

Computers.....New catalog describes newly developed systems for data handling & new series of analog computers; frequency meters; decimal counting units; time interval meters, etc. Catalog C-703.
460C Beckman Instruments.

Controllers.....Features the M/58 Controller's revolutionary floating disc system—the exclusive design development that gives M/58 Control its unique versatility, precision, stability. Request Bulletin No. 13-19.
46-7 *Foxboro Co.

* From advertisement, this issue

LOVEJOY

Variable SPEED PULLEYS

SELECT-O-SPEED TRANSMISSIONS

Save You Money

HERE'S WHY:

- ECONOMICAL IN COST compared to other variable speed transmission equipment. Simple in design but rugged in construction to give you long dependable service.
- EASILY INSTALLED on new or old equipment. Just as easy to operate. Finger-tip adjustment gives the right speed instantly.
- MAINTENANCE IS NEGLIGIBLE. No complicated mechanisms to get out of order. All parts can be readily inspected. Belts can be quickly adjusted or replaced.

Lovejoy Variable Speed Pulleys

are available in a complete range of sizes from fractional to 15 hp., ratios to 3 to 1.

Shown is a typical Lovejoy countershaft unit controlling speed of automatic spring coiler.

Lovejoy Select-O-Speed Transmissions

can be supplied with hand wheel or lever control. Fractional to 5 hp., ratios to 10 to 1.

This Lovejoy Select-O-Speed is used to control the speed of a printing press.

For your variable speed application, there is a type and size Lovejoy unit that will give you initial economy, dependable performance and long service life.

GET FULL DETAILS NOW!

Request Catalog

LOVEJOY FLEXIBLE COUPLING CO.

4961 W. LAKE STREET • CHICAGO 44, ILLINOIS

Mfrs. of Flexible Couplings, Variable Speed Pulleys and Transmissions, Motor Bases and Universal Joints.

LITERATURE . . .

Controllers, Electro-Pneumatic.....New bulletin describes an electro-pneumatic controller, used for measurement and control of current to AC motors or other AC circuits. Request Specification Sheet GE-500.
461A Hagan Corp.

Controls.....Blanks undergo 3-hour curing cycle . . . are brought slowly from room temperature to 320°F., then held there for 1½ hours. Partlow controls are used in several H-1 operations. Request Condensed Catalog.
464 *Partlow Corp.

Controls, Liquid Level.....Literature describes relays and starters, automatic starter and relay combinations, multiple pump controls, special controls and panels. Complete information in product catalog.
461B B/W Controller Corp.

Controls, Temperature.....Completely illustrated, 16 p. catalog presents company's line of standard local mounted temperature controls. Includes theory, features, general specifications, etc. Catalog Section 100.
461C United Elec. Controls Co.

Controls, Temperature.....17 p. catalog presents company's line of remote bulb temperature controls . . . industrial, aircraft, marine, special purpose. Includes features, specifications, etc. Catalog Section 200.
396 *United Elec. Controls Co.

Controls, Valve.....Time, labor & money can be saved by opening & closing valves with LimiTorque . . . "just press the button." There's a type & size of LimiTorque for every valve operating need. Catalog L-550.
98 *Phila. Gear Works.

Flowmeters.....New 4 p. catalog describes function, construction & operation of Laub Electro-Caloric Flowmeter. Lists advantages of this revolutionary new instrument, mechanical & electrical specifications.
461D Industrial Development Labs.

Gages.....With proper application, the new Supergauge will last a lifetime. Supergauges are available in 4½" and 8½" sizes. For information on case styles, materials of construction, etc., request Publication 1819.
402 *U. S. Gauge Div.

Gages.....For pressure, vacuum or compound service. There are no gears or teeth to wear out. Cam wiping action keeps contact points clean & smooth. Provides complete information in Gage Catalog No. G-2.
374 *Helicoid Gage Div.

Gages, Force.....Bulletin describes new series of force gages for the accurate measurement of dynamic forces in any system or structure. Models 2103 & 2104 provide outputs of approx. 5 volts full scale. Bulletin 801-241.
461E Endevco Corp.

Gages, Vacuum.....Outstanding for accuracy and ability to withstand hard usage. Model 520 is an all-purpose gage with uniquely wide range and accuracy. Company makes further information available upon request.
345e *National Research Corp.

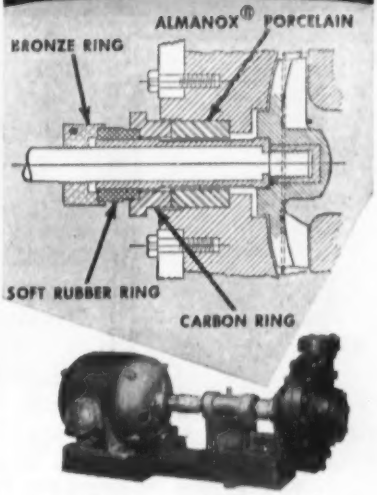
Gages, Vacuum.....Offers catalog describing new Hastings Vacuum Gage, single meter type, with a range of 0-100 microns Hg full scale. Gives dimensions & reports two other single meter model instruments.
461F Hastings Instrument Co.

Indicators, Moisture.....Illustrated data sheet describes features of Precision "Aquatrator", including the Mag-Mix Stirrer & electric meter which indicates end points of determinations. Data Sheet 11259B.
461G Precision Scientific Co.

Indicators, Portable.....Compact, lightweight unit weighs under 4 lbs. and measures only 4"x5"x6". Yet it has a double scale 23½ inches long. Company makes further information available in Bulletin 64.
472a *Thermo Electric Co.

* From advertisement, this issue

It's NEW...
Improved Seal on... Hard Rubber Pumps for Chemical Solutions



How This Improved Seal Works

New mechanical seal on all Luzerne Pumps is made by using a revolving karbate ring against a stationary almanox® porcelain ring. This permits a rubber covering on the metal shaft and eliminates usual packing troubles due to friction and leaking of conventional packing.

® Franchtown Porcelain Co. Trade Mark

OTHER FEATURES

- Safely handles corrosive solutions
- Standardized parts for field repair
- Available in natural hard rubber or Buna-N synthetic rubber compounds to handle temperatures up to 225° F.

SPECIFICATIONS

Style A — Open impeller pump — 140 gallons per minute at 90 feet head maximum.

Style B — Open or closed impeller pump — 115 gallons per minute at 68 feet head maximum.

2" — Suction 1½" — Discharge

Write for complete information or contact our sales representative nearest you.

The LUZERNE RUBBER CO.

100 Muirhead Avenue Trenton, N. J.

Sales Representatives

L. A. RUBBER & ASBESTOS WORKS
122 East Third Street
Los Angeles 13, Cal.

ALBERT J. COX COMPANY
565 West Washington St.
Chicago 6, Ill.

R. C. FOLTZ COMPANY
P. O. Box 13313
Houston 19, Texas

"NETONE" Filter Paper is a neoprene impregnated kraft paper that offers decided mechanical and chemical advantages over standard filter papers.

When compared to 60-pound unbleached kraft "NETONE" Filter Paper shows a 500% increase in wet tensile strength, wet burst factor increases from 6 to 57 and there is a marked increase in abrasion and crease resistance.

The following are a few test results indicating comparative resistance factors.

Solution	60-Pound Kraft	Wet Strength Resin	Neoprene Treated (3%)
H_2O	0	72 hr.	86 hr.
10% HCl	0	6 min.	4 hr.
10% NaOH	0	6 hr.	72 hr.

Write us about your requirements and we will be glad to send samples for your testing.

. . . And for your filter cloth requirements we weave fabrics of VINCEL*, Saran, Nylon, ORLON**, Glass, VINYON N†, TEFLON††, DACRON*** and Polyethylene. Samples sent on request.

* TM—NFM Reg. U.S. Pat. Off.
** TM for Du Pont acrylic fiber
*** TM for Du Pont polyester fiber
† TM—Union Carbide and Chemical Co.
†† TM for Du Pont tetrafluorethylene fiber

Weavers of Industrial Filter Media for over Fifty Years

The National Filter Media Corp.

General Offices & Mills: New Haven 14, Conn.
Western Office and Factory: Salt Lake City 2, Utah

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Chicago, Ill.: 3557 W. Peterson Ave.
Cincinnati, Ohio: Roselawn Center Bldg.
Houston, Texas: 1503 Hadley St.
Oslo, Norway: Nicolai Friis
Johannesburg, South Africa: Edward L. Bateman

LITERATURE . . .

Instruments, Dewpointer.....Alnor Dewpointer makes it easy to achieve consistent accuracy. Means faster readings with no time lost calculating variables. Complete details available in Dewpointer Bulletin.
L457 *Illinois Testing Labs.

Meters.....The Betameter is used to measure and control sheet thickness, basis weight, coatings, etc. in continuous manufacturing processes. Employs beta radiation for accurate measurement. Request details.
462A Isotope Products.

Meters.....Neptune meters speed batch mixing; have automatic control; eliminate losses; eliminate insanitary conditions; save time, space; offer accurate inventory and cost control. Request Data Book 566-Q.
466 *Neptune Meter Co.

Meters.....Offers data on Multimeter Type LM-1, a useful instrument in all phases of industry where accurate measurement of resistance AC and DC voltages & Dc current are encountered. Catalog No. L5010.
462B Radio Corp. of America.

Meters, Corrosion.....Corrosometer . . . direct readings, micro-inch sensitivity, probes of 30 alloys, for all corrosive systems. Meets requirements in chemical processing and laboratory testing. Request details.
462C Crest Instrument Co.

Modulators, Crystal.....Company offers information on their Crystal Modulator MI-30451, used in conjunction with Signal Generators LG-22 and LG-23. Includes specifications and applications. Catalog 1,4080.
462D Radio Corp. of America.

Recorders.....New 8 p. bulletin describes the American Microsen Series 130 Millivoltmeter & Microammeter Recorder. Includes functions, principle of operation, design features, etc. Bulletin MG10.
462E Manning, Maxwell & Moore.

Testers, Fineness.....Bulletin describes the Precision-Blaine Air Permeability Fineness Tester for determining the fineness of Portland cement, pharmaceutical powders & other granular materials. Buletin 233.
462F Precision Scientific Co.

Transmitters, Differential Pressure.....The new Taylor Fixed Range Differential Pressure Transmitter (200TD 111) provides an excellent, economical means of measuring flow, liquid level, or pressure. Bulletin 98274.
46-1 *Taylor Instrument Cos.

Transmitters, Flow.....New line of high-head differential pressure transmitters features low cost, accuracy, rangeability, simplicity, and flexibility. Full details contained in Product Spec. P22-6.
462G Bailey Meter Co.

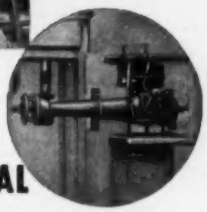
Transometers.....New bulletin shows how to meter, integrate and control with Askania Transometer. Describes flow, indication, recording and control applications for fuel oil, viscous & other liquids. Bul. 301.
437 *Askania Regulator Co.

* From advertisement, this issue

Now turn to the back . . .

Simply circle the code numbers desired on the handy pre-paid postcard, and mail it to us. Replies will reach you direct from the companies manufacturing the product.

VERTICAL



OR

HORIZONTAL

many more hours on stream without forced shutdown with NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . *plus:* special, pre-cast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and all steel duplex detaching gear which enables swift, simple vertical burner changeover.

VERTICAL and HORIZONTAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy through more rapid combustion with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Units allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

The VERTICAL or HORIZONTAL Tandem Unit is always fired with National AIROIL Combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame temperature using either fuel oil or gas. With the TANDEM UNIT'S clean flame, a cold furnace can be brought to full capacity in a short time.

"Many, many more hours on stream, without shutdowns" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

1235 EAST SEDGLEY AVE., PHILA. 34, PA.
Southwestern Division
2512 South Boulevard, Houston 6, Texas
INDUSTRIAL OIL BURNERS, GAS BURNERS, AND FURNACE EQUIPMENT

LITERATURE . . .

Voltmeters.....Company offers information on their DC Null Voltmeter, Type LV-14, having wide application in the test or calibration of numerous types of equipment. Includes specifications, etc. Catalog L1010.
463A Radio Corp. of America.

Pipe, Fittings, Valves

Accessories, Installation.....New 16 p. catalog of Installation Accessories for lubrication, hydraulic, steam, liquid, & air applications. Contains complete information, specifications, & prices. Catalog No. 17-E.
463B J. N. Fauver Co.

Coils.....20 p. bulletin describes Type W, B, and C Standard hot water coils, as well as a new high capacity Type B Booster Coil. Includes dimensions, specifications, applications, coil selection, etc. Catalog 404.
463C McQuay, Inc.

Couplings.....Offer a new coupling Selection Chart, which reduces time necessary to select a flexible coupling to a matter of minutes. Gives critical specifications of Roller Chain, Morflex & Silent Chain Couplings.
463D Morse Chain Co.

Engineering Service, Joints.....Barco will work with your engineers in the selection of joints to meet your requirements. Offers complete line of joints. Company makes full details available in Catalog Sheet 229.
452b *Barco Mfg. Co.

Extrusions.....New 6 p. folder covers company's extruded products, describing facilities for the production of tubular & solid shapes & explaining the Ugine-Sejournet hot extrusion process. Folder TB-413.
463E Babcock & Wilcox Co.

Fittings, Forged Steel.....28 p. catalog on forged steel pipe fittings contains complete dimensional, engineering and application data on forged screw-end and socket-welding fittings for high pressure service. Bulletin A-3-56.
405 H. K. Porter Co.

Fittings, Stainless Steel.....Speedline fittings simplify pipeline design. Details of the greater design flexibility possible with Speedline fittings . . . at lower cost . . . available in new fully illustrated catalog.
140-1 *Horace T. Potts Co.

Gasket Materials.....Company offers information & prices for "Lo-Flo" Gasket Materials, a new gasket material comprised of Teflon & inert fillers. Withstands temperatures up to 600 degrees with no distortion.
463F Balfour Industries.

Hose, Metal, Flexible.....Produced in various alloys of stainless steel—in monel, bronze, and carbon steel. Ideal for use with high temperature and high pressure corrosive gases and liquids. Bulletin 21-A.
323 *Atlantic Metal Hose Co.

Joints, Ball, Swing & Strut.....Interesting new illustrated bulletin shows petrochemical and petroleum industry applications for Barco ball, swing, and strut joints. For complete details, request Bulletin No. 28.
452a *Barco Mfg. Co.

Joints & Bellows.....Sola-Flex bellows & expansion joints are made in all sizes & varieties. They are durable, economical, & are based on advanced engineering designs. Request your copy of the latest Catalog.
66 *Solar Aircraft Co.

Joints, Expansion.....New 72 p. catalog covers the design, manufacture and application of the company's line of packless corrugated expansion joints, including three new types. Request Catalog #56.
463G Zallea Bros.

* From advertisement, this issue

BE SURE OF A PERFECT CONICAL SHAPE SPRAY ALL THE TIME WITH *Monarch*

For a perfect spray, many plants prefer Monarch nozzles.

These advanced design nozzles reduce clogging and guarantee dependable applications to . . .

- ACID CHAMBERS
- AIR WASHING
- CHEMICAL PROCESSING
- COOLING PONDS
- DESUPERHEATING
- GAS SCRUBBING
- HUMIDIFYING
- SPRAY DRYING

Send for catalogs 6A and 6C

Monarch
MFG. WORKS, INC.
2517 E. ONTARIO ST.
PHILADELPHIA 34, PA.

One of the three gas-fired ovens for curing H-I Fishing Rod blanks. Partlow Model RCS Recording Control is visible on outside of oven.

Close-up of Partlow Model RCS Recording Control on H-I curing oven. Each oven is governed by one of these controls.

Partlow Controls help put more fun in fishing with H-I Power Glass Rods

No matter what you make, Partlow Controls will help make it better!

Horrocks-Ibbotson Co., Utica, N.Y., manufacturers of the world's largest line of fishing tackle, depends on Partlow Controls for accurate heat in curing woven glass rod blanks. Pin-point heat control is necessary to assure proper resiliency and action in the finished rod.

Blanks undergo a 3-hour curing cycle . . . are brought slowly from room temperature to 320°F, then held there for 1½ hours.

Partlow Controls also are used in several other H-I operations.

BRING YOUR TEMPERATURE CONTROL PROBLEMS TO PARTLOW

There's a Partlow model just right for your job . . . for use with oil, gas, steam or electricity.

Write today for Condensed Catalog **Dept. -1056**

partlow

the pioneer in mercury thermal controls

THE PARTLOW CORPORATION • NEW HARTFORD, N.Y.

Offices in All Principal Cities

LITERATURE . . .

Nozzles.....Describes company's line of nozzles for: oil atomizing, humidifying; air washing; desuperheating; spray ponds; milk powdering; acid chambers; concrete curing; etc. Request Catalogs 6-A and 6-C.
B463 *Monarch Mfg. Wks.

Nozzles, Spray.....Company makes available on request a completely detailed Catalog which provides valuable data on Spraco Nozzle line. Includes information on full cone, flat spray & hollow cone types.
438 *Spray Engrg. Co.

Nozzles, Spray.....Company provides a 48 p. industrial catalog with full data on thousands of standard and special nozzles—for every type of spraying. Also information on related equipment. Catalog No. 24.
T485 *Spraying Systems Co.

Operators, Pneumatic.....Company offers a new bulletin on pneumatic spring and diaphragm operators. Illustrates and describes Conoflow's Series B-10 B-20 Spring and Diaphragm Conomotors. Bulletin B-1020-5.
464A Conoflow Corp.

Pipe & Fittings.....For corrosion-resistant piping. Impervious graphite pipe & fittings readily installed, long lasting, easily maintained, unaffected by most corrosive fluids. Catalog Section No. S-7000.
257e *National Carbon Co.

Pipe Installation, Glass.....Pipe is easy to install & low in installed cost compared with other corrosion-resistant materials. Available in 6 standard sizes from 1- to 6-inch. I.D. inclusive. Installation Manual PE-3.
347 *Corning Glass Wks.

Pipe, Plastic.....Ace Rivivor is a new rigid threaded plastic pipe with good aging & high impact strength. Not affected by most inorganic acids & alkalis. Excellent for many organics. Request Bulletin CE-56.
384 *American Hard Rubber Co.

Pipe, Process, Aluminum.....Aluminum resists corrosive effects of chemicals like hydrogen peroxide, nitrogen solutions, many acids, alcohols, foods . . . and petroleum products like gasoline, kerosene. Request brochure.
63 *Reynolds Metals Co.

Pipe, Saran Lined.....Saran lined pipe, fittings and valves cut corrosion costs . . . can be cut in the field with available pipe fitter's tools. Liquid never touches metal in saran lined pipe. Request details.
71 *Saran Lined Pipe Co.

Pipe, Steam Traced.....Report savings of up to 30% in labor cost, plus important reductions in material and insulation costs. More detailed information on applications and methods of using Unitrace in Bulletin AD418.
261 *Aluminum Co. of America.

Shafting.....New Engineering Bulletin illustrates typical installations using flexible shafting and gives information on all sizes of shafting for either power drive or remote control applications. Bulletin #570.
464B Stow Mfg. Co.

Tubes.....More than 101 Duplex combinations are available—each designed to lick a particular combination of corrosive conditions. Company issues the Duplex Tube Handbook for complete details—Tech. Bulletin 1954.
155 *Bridgeport Brass Co.

Tubes, Condenser.....For condenser & heat exchanger tubes & plates specify Revere—cupro-nickel—30%, 10%; admiralty metal; arsenical copper; aluminum bronze—5%; etc. "Life Extension for Condenser Tubes."
267 *Revere Copper & Brass.

Tubes, Condenser.....Arsenical Admiralty-439 and Ambraloy-927 condenser tubes for normal service, and Cupro Nickel, 10%-755 and Cupro Nickel, 30%-702 for severe stress-corrosion cracking. Pub. B-2.
341 *American Brass Co.

* From advertisement, this issue

New ALUNDUM* 33-I Insulating Castable

Mixes and pours like concrete . . . protects up to 3300°F.

With ALUNDUM 33-I the ceiling of protection provided by insulating castables goes up to a new high. It is the most effective castable you can get for insulating at temperatures up to 3300°F. This new Norton refractory Rx provides maximum protection and quick, easy installation in many types of furnaces and other high temperature equipment.

Easy To Install And To Store

ALUNDUM 33-I comes in dry form, in moisture-protective bags. It mixes readily, in about five minutes — you just add water according to instructions. The consistency of the mix is as workable as any cement mix, and can be easily poured into any prefabricated form.

For full particulars, see your Norton Refractories Engineer. Or write to NORTON COMPANY, 509 New Bond Street, Worcester 6, Massachusetts.

NORTON
REFRACTORIES

Engineered... Rx ...Prescribed

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cat Tapes
*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

LITERATURE . . .

Tubes, Heat Exchanger.....Contain the right amount of antimony needed to resist dezincification and other forms of corrosion. For more information request Chase Condenser and Heat Exchanger Booklet.
351 *Chase Brass & Copper Co.

Tubes, Protecting.....Company issues new bulletin illustrating & describing the Serv-Rite line of ceramic protecting tubes. Lists various sizes of tubes available in different materials & prices. Bulletin No. 1000-56
465A Claud S. Gordon Co.

Tubing.....This flexible, plastic pipe—Tygon Tubing—in sizes up to 3" ID, is used extensively as temporary or permanent acid and alkali lines, etc. For complete product information, request Bulletin No. T-97.
231 *U. S. Stoneware Co.

Tubing....."12 Features of the New Look in Laminated Tubing" describes the "Tuff-Tube" new laminated fiberglass-epoxy tubing possessing properties not previously available in laminates. Contains electrical properties.
465B Lamtex Industries.

Tubing, Flexible.....Hundreds of applications in the steam and Diesel power fields are filled by Penflex flexible tubing. For complete information on product line, request copy of "Flexineering" booklet.
320 *Pa. Flexible Metallic Tubing.

Tubing, Thin-Wall.....Literature describes tubing in sizes with outer diameters from ⅛ to 2½ inches and with wall thicknesses of .035-inch and less. Includes applications, standard production limits, etc. Bulletin #4
465C Superior Tube Co.

Valves.....Line of steel valves feature dependable operation and low maintenance cost. Gate, globe and check types handle the most severe high-pressure, high temperature services. Full details in Catalog 20.
352 *Chapman Valve Mfg. Co.

Valves.....Golden-Anderson designs and manufactures valves that give dependable operation . . . that need little maintenance . . . that last a lifetime. Technical bulletins describing line are available.
TL475 *Golden-Anderson.

Valves.....New 2 p. data sheets give details and features of New Jerguson Drain or Sampling Valve in sizes from ¾" up to 2". Includes detailed specifications and engineering drawings. Unit No. 294.
465D Jerguson Gage & Valve Co.

Valves.....Company announces a new line of shut-off valves for the control of oil from 0 to 3000 psi and air from 0 to 2000 psi, capable of withstanding velocities up to 60 ft. per sec. Request Bulletins A-5 and O-5.
465E Barksdale Valves.

Valves....."It's Easier to Open or Close a Golden-Anderson Valve Than to Drive a Car With Power Steering" covers the reasons for this claim, and additional features of company's automatic valves. Bulletin G-4.
465F Golden-Anderson Valve.

Valves, Butterfly.....In this new Catalog you get the complete dimensions, layout drawings, specifications and materials for all pressure ratings of R-S Butterfly Valves that are now standardized. Catalog 160.
470 *S. Morgan Smith Co.

Valves, Butterfly.....New specification sheet describes a line of V-Port Butterfly Valves for the precise control of air or gas. Includes sizing & specification information. Request Sheet RM-1000.
465G Hagan Corp.

Valves, Diaphragm.....From antibiotics to the toughest acids, alkalis and salts there is a combination of Hills-McCanna body and diaphragm materials that will best suit your needs. Request Valve Catalog 100.
349 *Hills-McCanna Co.

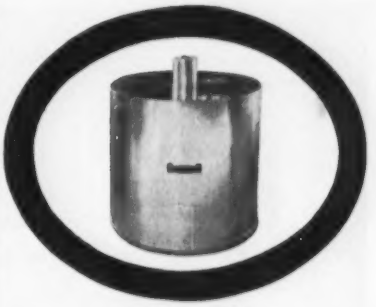
* From advertisement, this issue

LITTLEFORD

STAINLESS STEEL AND ALUMINUM FABRICATED PRODUCTS FOR THE

CHEMICAL

INDUSTRY



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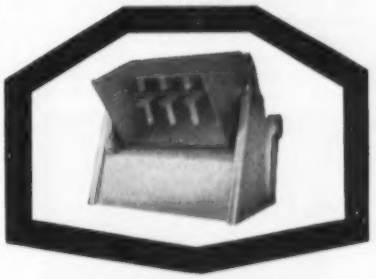

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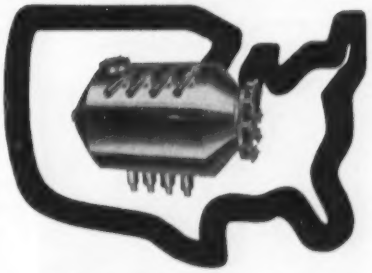


shipped anywhere

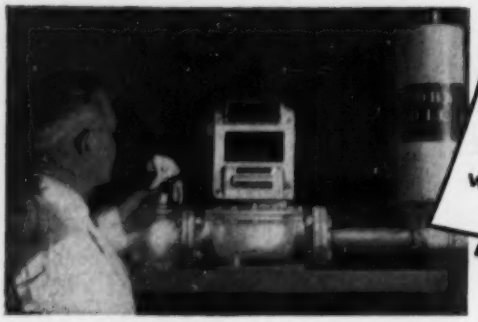
Littleford fabricates tanks, bins, vats, troughs, carts and special units . . . from stainless steel, aluminum, nickel, Monel or other non-corrosive metals. Matches your design with precision accuracy. For prompt service at low cost, rely on Littleford, fabricators of plate and sheet metal products for industry since 1882. Send us your blueprints for prompt estimates.

LITTLEFORD
LITTLEFORD BROS., INC.
Dept. CE 131, 453 E. Pearl St.
CINCINNATI 2, OHIO

Neptune Meters Do Far More than Just Measure!

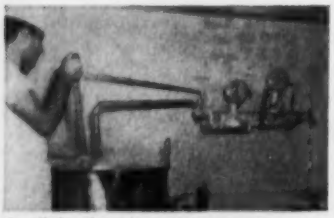
• THEY ARE MODERN PROCESSING INSTRUMENTS

• Here, for instance are a few ways you can save with Neptune:



By eliminating human errors in blending expensive ingredients, this meter paid for itself in one month!

Speed batch mixing by putting a standard Auto-Stop meter in each liquid ingredient line. Gives you *accurate* quantity control . . . *automatically.*



Small batches, from half a gallon to 20 gallons, are measured accurately with these two Neptune meters

Automatic control of pumps, valves, agitators, etc.: Simply rig Auto-Stop meters with electrical switches which are actuated when desired amount of liquid is delivered.

Eliminate losses due to rejected batches, spills and over-fills. Meters can't make "human" mistakes.

Eliminate unsanitary or hazardous conditions. Liquids stay inside the pipe all the way . . . no muss and fuss of gauge sticks, pails or batch tanks.

Insure full measure of liquid ingredient purchases

Save time, space, and labor costs by handling ingredients as liquids instead of dry solids. Many food plants find big savings in switch from granulated sugar to liquid sugar . . . with Neptune meters the key to accurate measurement.

Accurate inventory and cost control with less effort. All Neptune meters have totalizing counters to record consumption at every step in your process.

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LITERATURE . . .

Valves, Drain or Sampling.....Jerguson Drain or Sampling Valve is completely self-draining, withstands severe conditions, and offers foolproof operation. Request complete details on Drain Valve No. 23.
R451 *Jerguson Gage & Valve Co.

Valves, Lubricated Plug.....36 p. covers complete line of iron and steel lubricated plug valves available. Many illustrations of single, screwed and bolted gland type valves are shown. Request Catalog No. PV-4.
221 *Wm. Powell Co.

Valves, Needle.....The Marsh needle valve is now available in 416 stainless steel throughout. It is guaranteed for working pressure up to 10,000 psi. For complete details, request Bulletin No. NV-2.
T488 *Marsh Instrument Co.

Valves, Nickel Iron.....Designed for chemical process industries, valves are recommended for control of mildly corrosive liquids with minimum quantities of mineral acids. Details in Bulletin No. 118.
91 *Jenkins Bros.

Valves, Packless.....Packless valves are designed for tough applications, like critical high vacuums, corrosive or dangerous fluids and high temperatures. Company makes complete information available in a new Bulletin.
406 *Hoke Inc.

Valves, Porcelain.....Company makes available detailed literature covering the features and advantages of porcelain valves. Bulletin includes complete description, characteristics and specifications of product line.
279 *Lapp Insulator Co.

Valves, Safety Relief.....Offer valuable features: economical "2 in 1" design; peak performance; absolute protection; maximum interchangeability. Full range of sizes and pressures available. Details in Catalog No. 1900.
80 *Manning, Maxwell & Moore.

Valves, Solenoid.....Company offers information concerning their new full port, normally closed, packless solenoid valve. Designated as Type A, it features Magnatrol's unique removable operating assembly.
466A Magnatrol Valve Corp.

Valves, Solenoid.....New bulletin describes and illustrates additions to the line of bronze and stainless steel solenoid valves. Gives features, general specifications, list prices, etc. Request Bulletin No. F-1.
466B J. D. Gould Co.

Process Equipment

Absorbers.....For absorption of hydrogen chloride and other gases. Produce as much as 20 tons per day 22° Baume acid. Pneumatic automatic information in Catalog Section No. S-7460.
237a *National Carbon Co.

Blenders.....Company offers information on slow speed, high capacity blender, "Uni-Blend". Blends molasses, animal fats or fish solubles. Describes features, giving assembly diagrams, etc.
466C Strong Scott Mfg. Co.

Blenders, Spiral.....New Catalog gives exact specifications in light, medium and heavy duty blenders offered, plus information on special order design and service. Points out money-saving & time-saving improvements.
380 *American Welded Tank & Machy.

Centrifugals, Continuous.....Maxi-Flex centrifugals easily adjusted for maximum throughput . . . quality of filtrate and cake. Enables Maxi-Flex to give more speed and efficiency. Request Bulletin.
372 *Tolhurst Centrifugals Div.

* From advertisement, this issue

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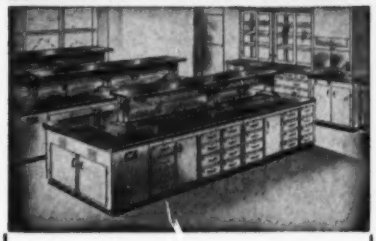

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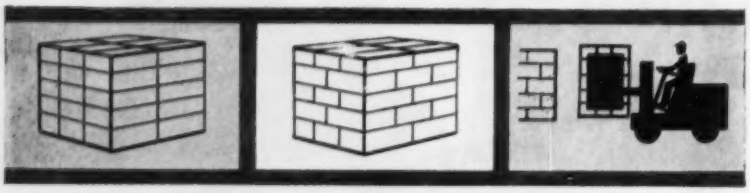

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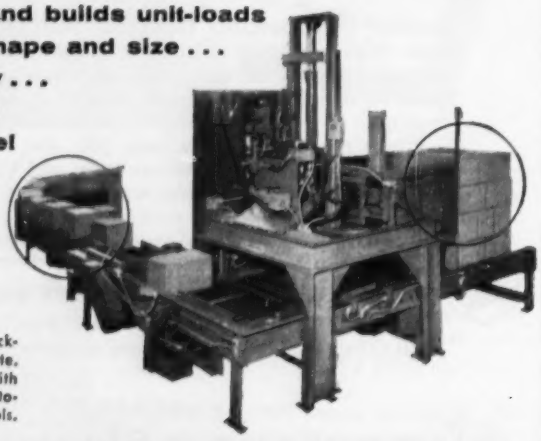
assembles and builds unit-loads in desired shape and size . . . automatically . . . directly from conveyor line!



UNITIZER handles packages up to 35 per minute. Can be furnished with selector switch or automatic sequence controls.

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- Basic design makes all parts easily accessible.
- Operating economy is assured with only 7½ HP required.

ASK STANDARD *how the UNITIZER expedites production while cutting handling costs. Contact the Standard representative listed in your classified phone book or write STANDARD CONVEYOR COMPANY, North St. Paul 9, Minn. Sales and Service in Principal Cities. Ask for Bulletin O-10.*

Standard GRAVITY & POWER CONVEYORS

50 years of conveyor experience

LITERATURE . . .

Clarifiers.....New 12 p. bulletin "The Dorrco Clarifloculator", describes the new combination flocculation and clarification mechanism, giving physical characteristics, types, sizes, advantages etc. Bulletin 6801-R.
468A Dorr-Oliver.

Classifiers.....Sharples super classifier with ultra-sharp cutpoint at high capacity for classifying dry powders gives product recovery of 80% to well over 90%. For details on outstanding features, request Bulletin 1280.
127 *Sharples Corp.

Collectors.....New 20 p. illustrated bulletin describes Walker Process Rectangular Collectors, giving complete description of features, design, dimensions and applications. Request Bulletin No. 8W68.
468B Walker Process Equipment.

Crushers, Jaw.....Cast, steel frame, manganese jaw & check plates. Large diameter shafts reduce shaft deflection & thus increase life of heavy-duty oversize roller bearings in bumper. Bulletin No. C12-B12.
388d *Denver Equipment Co.

Crushers, Sample.....Does the job quickly and efficiently. There is no loss of moisture content in sample. Any amount—from 0 to 20%—in one operation. Company makes literature available upon request.
T484 *American Pulverizer Co.

Cutters.....Bulletin describes Taylor-Stiles precision type General Purpose Cutters. Illustrates and describes Series 100 and 200, giving general construction features for several models. App. 212.
468C Taylor, Stiles & Co.

Deaerators.....Publication describes the many advantages of cold water deaerators; i.e. reduces or eliminates corrosion, complete deaeration without heating or cooling, etc. and principles of operation. Pub. 4653.
468D Cochrane Corp.

Dryers.....Lectro-dryers can dry air & gases in volume to dewpoints below −100°F.—can drop relative humidity lower than 10%. Booklet describes machines & how various industries use them to gain efficiency.
342 *Pittsburgh Lectrodryer Corp.

Dryers.....Available in several types: direct heat, indirect heat, and steam tube. Let Deco engineers help solve your drying problem—no dryer problem too small or too large. Details in Bulletin No. D4-B2.
388j *Denver Equipment Co.

Dryers, Rotary.....The Davenport rotary hot air dryer is of stainless steel construction. Dryer is installed in one of the large processing plants, drying wheat gluten. For complete details, request Catalog "A."
BR471 *Davenport Mach. & Foundry.

Drying Systems, Flash.....Systems offer means for handling materials in which drying is combined with pulverizing, or with mild disintegration, or followed by cooling & conveying product to storage. Catalog No. 82.
364 *Raymond Div.

Dust Collectors.....In almost every type of industry . . . users have found high efficiency, simplicity & economy of Dustube collectors a difficult combination to equal for top performance. Request Bulletin No. 372.
304 *Wheelabrator Corp.

Dust Collectors.....Maximum filtering efficiency, bag cleaned uniformly and automatically, overcleaning eliminated to prolong bag life, easy to assemble in less space. For further details, request Aeroturn Booklet.
263 *Koppers Co.

Dust Collectors.....Features of the Air Tumbler are: simple-dependable; no fire hazard; high efficiency; constant capacity; low operating cost. Company makes complete information available in Bulletin 551.
468E Dust Suppression & Engrg.

* From advertisement, this issue

This underwater photo dramatically illustrates speedy dispersibility of new Dow Corning Antifoam B.

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gives you the ultimate in foam-killing convenience

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LITERATURE . . .

Dust Filters.....28 p. book explains in detail the distinguishing features of reverse jet filters. Contains schematic operating diagrams, performance curves for various types of dust. Request Bulletin No. 559.
404 Day Co.

Ejectors, Steam Jet.....The steam jet ejector is the ultimate in mechanical simplicity, consisting of only 3 basic parts—a steam nozzle, a suction chamber & a venturi-shaped diffuser. Bulletin 9013-A.
B481 *Ingersoll-Rand Co.

Eliminators, Mist.....If liquid entrainment is a contributing factor in design or operation, Metex Hi-Thruput Mist Eliminators will assure greater production, improved quality of yield and reduced costs. Bul. ME-6.
112 *Metal Textile Corp.

Filter Aids.....For clearest filtration, use Solka-Floc filter aid. 99.5% chemically pure cellulose, Solka-Floc comes in a wide range of grades to meet your specific needs. Request literature and samples.
370 *Brown Co.

Filter Paper.....The use of E&D filter paper as a cover may be indicated if your filter medium is blinding or clogging. Will recommend proper grade for use and send samples for testing. "Filtration Analysis Report."
T486 *Eaton-Dikeman Co.

Filter Sheets.....Complete range of stainless steel plate & frame sheet filters now available. Ideal for products ranging from ultra fine pyrogen solutions to coarse prefiltered bulk chemicals. Catalog.
B485 *Ertel Engrg. Corp.

Filters.....New 5-micron filter provides 50% longer service life, polishes, purifies liquids to sparkling clarity, handles highly alkaline fluids. Company makes complete details available upon request.
R475 *Cuno Engrg. Corp.

Filters, Disc.....Special patented design of segments in filters use both gravity & vacuum to give a drier filter cake. Drainage is complete & positive with no blow-back. Details contained in Bulletin FG-B1.
388f *Denver Equipment Co.

Filters, Pressure.....Illustrated bulletin describes the Dorr-Oliver "Hi-Rate" pressure filter, a new pressure filter specifically designed for high capacity water filtration. Request copy of Bulletin No. 9200.
469A Dorr-Oliver.

Filters, Pressure Leaf.....For flow rates two to five times greater than cloth covered presses: positive removal of all suspended solids to desired degree of clarity; etc. Find details in Catalog No. NC-1-53.
373 *Niagara Filters Div.

Generators, Inert Gas.....At a moment's notice of fire or explosion dangers, smothering gas flows instantly from R-C inert gas generators. Details on how they afford constant protection in Bulletin IGG-155.
401 *Roots-Connersville.

Generators, Inert Gas.....Assure a safe, dependable supply of chemically clean inerts. Deliver inerts at a special analysis . . . without fluctuations. For facts and technical data, request Bulletin No. 1-10.
83 *C. M. Kemp Mfg. Co.

Grinders.....Company offers information on their industrial grinding equipment which provide economical grinding and pulverizing of a variety of materials to any commercial standard. Form No. 5541.
469B Jacobson Machine Works.

Kettles.....New illustrated catalog shows the completely redesigned line of Hamilton kettles. Includes a wide range of steam jacketed kettles, mix cookers, pressure cookers, tilting kettles, vacuum kettles, etc.
469C Hamilton Copper & Brass.

* From advertisement, this issue

McGraw-Hill Book News

AIR POLLUTION HANDBOOK

Brings together in readily usable form much information for analyzing and solving various air pollution problems. Covers theoretical, technical and practical aspects—discusses causes, effects, and controls in chapters covering the science of air pollution, the effects on plants and animals, and the various corrective techniques. **Edited by Paul Magill, Francis Holden, and Charles Ackley, all of Stanford Research Institute. 672 pages, illustrated, $15.00**

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HIGH PRESSURE TECHNOLOGY

Treats of the influence of elevated pressure on chemical and physical systems, and on the design of equipment for handling these systems experimentally or on a commercial scale. Chapters deal with stresses and strains in thick-walled cylinders; with examples of apparatus used in measuring the properties of matter at high pressures; and with design of chemical reactors as a background for the special application to high pressure chemical reactors. **By Edward W. Comings, Professor of Chemical Engineering, Purdue U. 570 pages, illustrated, $11.50**

ENGINEERING AS A CAREER

What are the opportunities and rewards in engineering? What does the engineer do? What does he need to know? This book answers these questions — surveys, training possibilities — previews the fundamentals of engineering materials and mechanics, thermodynamics, electrodynamics, and engineering economy. **By R. J. Smith, Head, Engineering Dep't., San Jose State College. 365 pp., illus., $4.75.**

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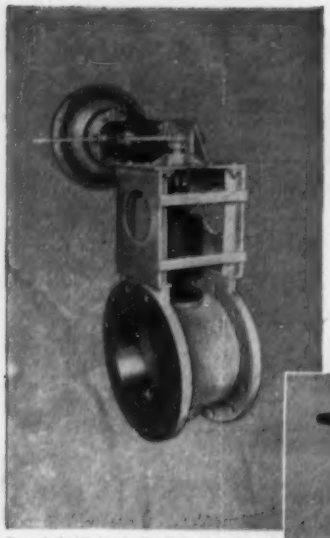

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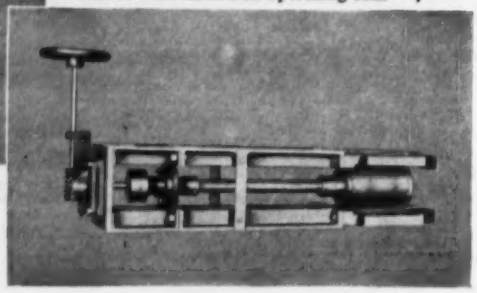
BUTTERFLY VALVES

All-bronze, 150-pound R-S Valve for operation at −300° F. Valve is installed with 18″ insulation in operating cell. ▼



Special 12-inch R-S Butterfly ▲ Valve, with finned lubricated stuffing box, is used for service with hot gases at 1,000° F.

SPECIAL R-S VALVES SOLVE TEMPERATURE, CORROSION, ABRASION PROBLEMS

To meet rugged processing conditions, R-S Butterfly Valves can be built to your requirements. For valve bodies and parts, any metal or other material that can be cast or welded — even plastics — may be specified.

There are a number of materials available to meet extreme working conditions involving corrosion, abrasion, erosion, high heat and pressure. In addition, the **R-S** Rubber-lined Valve may be specified to resist certain types of corrosion. Every R-S Valve gives you quick and positive closure with any type of controls, uniform control in normal regulating ranges and minimum pressure drop.

If your past experience offers no precedent, you can call on our background in specialized valve engineering to solve material problems.

We have built valves to operate in a temperature range of from −300° F to +2,000° F. For complete information on our complete line of butterfly, ball and cone valves, see our local representative or write S. Morgan Smith Company, York, Pennsylvania.

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LITERATURE . . .

Kilns, Rotary.....efficient thermo-processing of products. Used in the production of lime, bauxite, cement, sodium silicate, alumina, etc. Complete data on design features offered in illustrated Bulletin 1115.
348 *Traylor Engrg. Mfg. Co.

Mills.....Company offers literature covering: conical mills, disc-roll mills, tube mills, tricone mills, cylindrical mills, batch mills and rod mills. For complete information, request Bulletin AH-474-11.
480a *Hardinge Co.

Mills, Attrition, Single Run.....Versatile size reduction unit rubs, cuts, tears, crushes, grinds, granulates, pulverizes, twists, curls, hulls, and blends. Company makes details available in Bulletin No. 143.
297 *Sprout-Waldron.

Mills, Ball.....A steel-head ball mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Bulletin No. B2-B13.
388b *Denver Equipment Co.

Mills, Grinding.....New publication covers the outstanding features that give the Futura Grinding Mill its unexcelled ability to grind materials with maximum efficiency, at lower cost. Brochure No. B-562.
470A Patterson Foundry & Mach.

Mills, Hammer.....Williams heavy duty hammer mills: increase your output; improve product quality; reduce your cost-per-ton. For complete details of features and advantages, request complete product reference.
69a *Williams Patent Crusher

Mixers.....Describes the Day Imperial Mixer. Built for heavy duty, engineered for precision, it incorporates many advanced engineering features to assure you high production at low cost. Bulletin No. 600.
397 *J. H. Day Co.

Mixers.....Company makes available Confidential Mixing Data Sheet. Helpful checklist enables you to develop a complete technical description of agitation required for your process, quickly & easily. No. B-107.
215a *Mixing Equipment Co

Mixers.....Nauta Mixer features uniform, quick mixing of any number of dry materials, similar or entirely different in characteristics. Describes features and industries where it is profitably used. Catalog 374.
292 *Blaw-Knox Co.

Mixers.....Philadelphia Fluid Mixers offer more horsepower capacity per dollar & are easier to install & less expensive to service. Perform smoothly & economically. For complete story Bulletin A-156.
288 *Philadelphia Gear Works.

Mixers.....Describes Super Agitators & Mixers. Patented standpipe around propeller shaft assures positive agitation & circulation. Patented wearing plate prevents sand-up on shut-down. Bulletin No. A2-B4.
388a *Denver Equipment Co.

Mixers.....Company offers information on their Turn-Rotor Continuous Mixer, featuring positive moisture control. Gives assembly diagram, list prices and dimensions and describes all features.
470B Strong Scott Mfg. Co.

Mixers, Portable.....Use in industry reduces costs, saves time, labor and secures better and more refined products. Catalog includes data on construction, dimensions, specifications, etc. 28 p. Bulletin B-108.
215b *Mixing Equipment Co.

Mixers, Pug Mill.....Company offers information on new efficient laboratory model pug mill mixers for small quantity mixes, for use with hot, cold, wet or dry mixes. Includes specifications & applications.
470C Lindcraft Corp.

* From advertisement, this issue

CHEMICAL ENGINEERS ARE LICKING THEIR HIGH PIPE COIL COSTS BY SWITCHING TO

DEAN THERMO-PANEL COIL

Notice in the above photo how easy it is to lift the Dean Thermo-Panel Coil for installation or for renewal when you want to clean the tank or coil. You can't do that with an old-fashioned large, heavy, expensive, inefficient pipe coil. Also, much time is saved.

For big money savings every chemical engineer should study our 52-page Technical Data Bulletin No. 355 which tells about numerous applications of this remarkable device for heating or cooling via steam, water, etc. And Bulletin 256 gives prices and shows how you can do your own estimating. Which shall we send? 355? 256? Both? And, if you wish, our engineers will help without obligation.

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We'll be happy to place your name on our mailing list to receive regular issues of the "Kutztown REVIEW".

Covering an area of 10 acres, this modern plant has facilities second to none . . . and more than 85 years' experience producing quality castings for the chemical industry.

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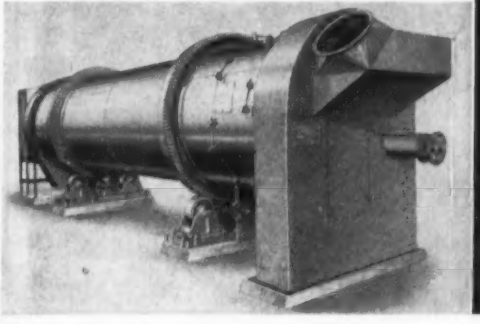
HOT AIR DRYER 6'0" dia. x 25'0" long



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PRESSING – DRYING and COOLING Equipment
Continuous DeWatering Presses
ROTARY DRYERS Steam Tube, Hot Air and Direct Fire
Atmospheric DRUM DRYERS
ROTARY COOLERS Water and Air

Cereal Process Drying

This "Davenport" Rotary Hot Air Dryer is of stainless steel construction. Dryer is installed in one of the large processing plants, drying wheat gluten.

Let our engineers consult with you on your Pressing, Drying, and Cooling problems. Send for complete Catalog A or for quick reference, consult your *Chemical Engineering Catalog*, 1954 or 1955.

davenport MACHINE and FOUNDRY COMPANY
DAVENPORT, IOWA U. S. A.

NEW TEST EQUIPMENT FROM THERMO ELECTRIC

MINIMITE Portable Indicator

A midget-size portable potentiometer indicator—this compact, lightweight unit weighs under four lbs. and measures only 4" x 5" x 6". Yet it has a double scale 23½ inches long! Standard range includes a scale of 0°–1800° F. for Iron-Constantan and one of 0°–2400° F. for Chromel-Alumel. Other scales also available. Another outstanding feature—the "Mini Mite" serves a dual purpose! It can be used to measure temperature directly when connected to a thermocouple, or, to check other potentiometer or millivoltmeter type instruments when used as a comparison instrument. A three-position switch permits quick selection of scale or elimination of cold-junction compensation. Write for Bulletin 64-E.

Thermocouple Calibration Console

This complete equipment package was designed for industries requiring frequent calibrations to maintain temperature measuring accuracy. Highly flexible in performance, it provides precision calibration of thermocouples and other temperature sensing devices, checking of portable standards, and the accurate indication of any millivolt signal for calibration or laboratory test purposes. Calibration range from 32° to 2000° F. Write for engineering data EDS-23-E.

Other NEW T-E Instruments

"AutoRef" Cold-Junction Unit ● Portable Self-Balancing Indicator
Multi-Point Controller ● Standardized Ten-Point Midgit Monitor
Self-Balancing Indicator with Remote Selector and Digital Readout

Pyrometers • Temperature Monitoring Systems • Thermocouples • Protection Tubes
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Thermo Electric Co., Inc.
SADDLE BROOK, NEW JERSEY
In Canada — THERMO ELECTRIC (Canada) Ltd., Brampton, Ontario

LITERATURE . . .

Mixers, Side Entering.....Furnishes detailed information on features, typical applications, mechanical design, maintenance, shaft seals, methods of installation, etc., in completely illustrated Catalog B-104.
215c *Mixing Equipment Co.

Mixers, Top Entering.....Illustrated and detailed 32 p. Catalog includes advantages, typical installations, mechanical description, construction information, dimensions and selection tables, etc. Catalog No. B-102.
215d *Mixing Equipment Co.

Mixers, Top Entering.....Makes available pertinent information on top-entering mixers (propeller type) . . . for closed tanks, pressure & vacuum . . . for open & loose-covered tanks. Data in Catalog No. B-103.
215e *Mixing Equipment Co.

Mixing & Grinding Equipment.....Information on #41L-10 gal. double arm kneader, #52TC-14" x 32" high speed three roller mill, #130H-250 gal. change tank mixer & #130EL-1 gal. double planetary type change can mixer.
R383 *Charles Ross & Son Co.

Presses, Filter.....Offer numerous features: lowest cost per sq. ft. of filtering area; produces perfect clarity of filtrate; can be used in decolorizing—deodorizing; etc. Request illustrated Catalog No. 55.
439a *T. Shriver & Co.

Presses, Wax Molding.....Press cools and molds paraffin or natural wax, or other substances, into multiple cakes of uniform size, weight and appearance, without shrinkage. For complete details, request Bulletin 127.
439d *T. Shriver & Co.

Process Units, Turba-Film.....Turba-Film process units can help you in normal or specialized applications, either as an individual unit or as part of engineered "package systems." Request further information.
295 *Rodney Hunt Machine Co.

Processing Equipment.....Describes corrosion-resistant processing equipment . . . precision built to your specific requirements to give long years of peak performance with low maintenance. Technical Bulletins.
391 *Lee Metal Products Co.

Processing Equipment, liquid.....Presents a fully illustrated, 32 p. reference describing "Sealed-Disc" and "Disc-Pak" filters, transfer pumps, portable mixers, tanks, agitators, etc. Request copy of Bulletin No. G-255.
R457 *Alsop Engrg. Corp.

Producers, Gas.....4 p. publication gives application data, product descriptions, dimensions, ratings & diagrams of General Electric Thermalene (endothermic) gas producers. Also contains operating data. Bulletin GEC-1391.
472A General Electric Co.

Propellers.....“Fabricated” propellers accurately balanced and pitched will do a perfect job of mixing, blending, stirring, pumping or aerating in any application requiring low HP and not over 1750 RPM. Catalog.
BL475 *Michigan Wheel Co.

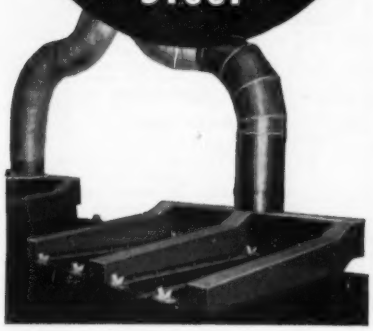
Pulverizers.....Valuable data on Superfine pulverizer . . . a centrifugal air attrition impact pulverizer and classifier in a single unit. Covers numerous features, specifications, construction, etc. Illustrated.
398 *Schutz-O'Neill Co.

Reactors, Chamber.....Reactor polymerizes plastic resins at controlled rate of heating and cooling to produce multiple slabs of finished product of any desired size, 12" to 56" square, from 1" to 5" thick. Bulletin 142.
439e *T. Shriver & Co.

Reactors, Glassed Steel.....Standardized glassed steel reactors can be stocked in sizes ranging from 50 to 4000 gallons. Program speeds shipments and lowers costs. For complete details, see Bulletin No. 902.
494 *Pfaudler Co.

* From advertisement, this issue

AGILE'S Plastic Ductwork Costs Less...Has Longer Service Life Than Stainless Steel



AGILE'S Plastic Installation

- **Cost** **$491.00**
- **Service....Still in use after 5 years**

Stainless Steel Installation

- **Cost** **$581.00**
- **Service....only 16 months**

PROBLEM: This company was using a type 19-9 stainless steel stack for venting the fumes on a sulphuric acid tank. This stack was installed at an original cost of $581, was no longer serviceable after 16 months because of corrosion.

SOLUTION: The company replaced the stainless steel installation with a plastic structure of equal dimensions for $491.00. The new stack still in perfect condition, has a life expectancy of many, many years.

Whenever you have a corrosion problem, check with American Agile. Many years of research and wide practical experience have made American Agile experts in the fields of plastics and corrosion prevention.

For detailed information be certain to write for your free brochure . AA-4

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American Agile Corp.

Plant and General Office

5461 Dunham Road • Maple Heights (Suburb of Cleveland), Ohio

Mail Address • P. O. Box 168, Bedford, Ohio

LITERATURE . . .

Reclaimer Systems, Oil.....A simple, economical and efficient method of restoring contaminated lubricating and sealing oil to the full value of new oil. Offers full details on reclaimers in Bulletin R-160.
371 *Hilliard Corp.

Samplers, Automatic.....Heavy duty units, extra rigid track and ball-bearing wheels assure positive travel and timing of sample cutter. Available in stainless steel for acid and corrosive service. Bulletin S1-B4.
388c *Denver Equipment Co.

Screens, Gyratory.....All-metal unit is designed to separate dry granular materials into two, three and four predetermined sizes. Information on Allis-Chalmers gyratory screens in Bulletin No. 07B8446.
357 *Allis-Chalmers Mfg. Co.

Screens, Vibrating.....For high-capacity screening of a broad range of materials—"CA" vibrating screens are your answer. In complete range of sizes to suit all plant capacity requirements. New Book 2554.
34a *Link-Belt Co.

Screens, Vibrating.....For economical separation of light to medium weight materials—choose "UP" vibrating screens. In open, semi-enclosed, or totally-enclosed types. Complete details contained in Book 2377.
34b *Link-Belt Co.

Separators.....New 4 p. bulletin describes Centrico's heavy duty separators with applications ranging from extraction of penicillin & vitamins to the purification & clarification of diesel fuels. Bulletin No. 2126.
473A Centrico, Inc.

Separators, Air.....Controlled centrifugal whirl by balancing forces separates rapidly, efficiently, cement, lime, clay, talc, ceramics, refractories, phosphates, coal & many other materials. Bulletin No. 087.
170 *Sturtevant Mill Co.

Separators, Magnetic ..... FerroFilter Magnetic Separators provide the positive method of extracting microscopic iron particles from liquids and slurries. Company makes full details available in Bulletin 56-E.
473B S. G. Frantz Co.

Tables, Concentration.....Separate materials into bands & handle coarsest sands with excellent results. Ideal for separation of groups of particles having similar range of specific gravities. Bulletin TI-B3.
388b *Denver Equipment Co.

Thickeners, Continuous.....Uses—washing slurry to remove impurities . . . thickening prior to filtration . . . thickening instead of filtration . . . decantation involving "fines." For Complete details, request Bulletin 122.
439b *T. Shriver & Co.

Trays, Bubble.....Glitsch "Truss-Type" bubble trays serve all processing plants . . . chemical—petro-chemical—natural gasoline—petroleum refining—AEC—etc. For details, request Technical Bulletin 150.
367 *Fritz W. Glitsch & Sons.

Washing Systems.....New 12 p. two-color bulletin "Oliver Brownstock Washing System" describes features, operation, components, sizes, adaptations & advantages of this brownstock washing system. Bulletin No. 3303
473C Dorr-Oliver.

Wire Cloth.....80 p. catalog describes company's facilities for fabricating wire cloth parts. Includes wire cloth parts for screening, filtering and special uses. Also provides helpful metallurgical information.
378 *Cambridge Wire Cloth Co.

Wire Cloth.....Publication "Multi-Matter" shows how wire cloth helps filter press users. Describes metallic fiber cloth blankets, plastic filter leaves, particle retentivity of metallic filter cloths, etc. Vol. 1, No. 2.
473D Multi-Metal Wire Cloth Co.

* From advertisement, this issue

CONFIDENTIAL

PLANT LOCATION FACTS

Where to find plenty of the right kind of WATER

New York State has water in great quantity and of the right quality for industrial operations.

We can provide the answers to all your questions on water supply at any New York State location and without cost to you. We have complete details on all the municipal water supplies in New York State. We can provide measurements of the quantity or rate of flow of most of the State's important surface waterways based on records kept for periods up to nearly half a century. In the case of ground water supplies, we can provide data concerning the probable yield and fluctuations in the water table at any New York State locality.

The character or quality of New York State's water, both surface and underground, has also been determined. Analyses are available which show the content of various mineral and other materials, hardness, pH range, temperature and many other factors. The water available for use at any given location can be specially sampled and analyzed for you.

Water won't be your only problem in deciding on a new plant location. You will want complete facts on labor, markets, available sites or buildings, power, fuel, transportation and raw materials to mention just a few. And you will want information on these as they apply to the successful operation of a specific plant.

A tailor-made report

Any or all of the factors important to your analysis will be covered in a confidential report to you—tailored to your needs. It will be prepared by a professional and experienced staff to cover either New York State locations of your choice, or, if you wish, sites which we will select on the basis of your needs.

Our booklet, "Industrial Location Services," explains what we can do for you. To get your free copy, write me at the New York State Department of Commerce, Room 651, 112 State Street, Albany 7, New York.

Edward T. Dickinson

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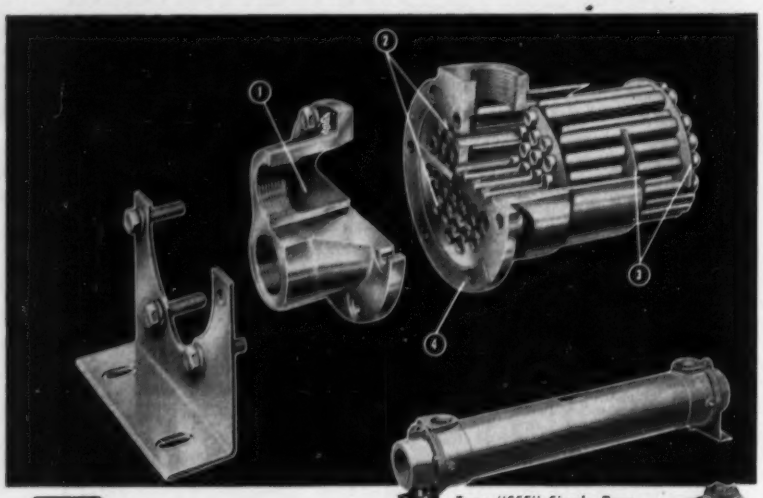
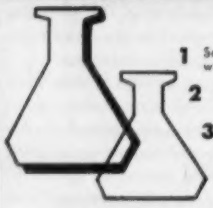
COMMISSIONER OF COMMERCE

Young Stainless Steel

corrosion-resistant heat exchangers



Type "SSF" Single Pass



1 Smooth flow bonnet distributes fluid with minimum turbulence to tubes.

2 Tubes are rolled into headers.

3 Baffles made to close tolerance.

4 Gasket eliminates by-passing, fluid leakage.

Type "SSF" Multipass

Chemical Pilot Plants Use Young

The challenging and exacting requirements of the Chemical industry as exemplified in its pilot plant operations are met and fulfilled by Young engineering talent. To heat, cool, condense or evaporate liquids and gases, chemical pilot plants need heat exchangers which are *compact, economical, dependable* and *resistant to acids and corrosion.* Young Stainless Steel "SSF" Heat Exchangers are the answer to this requirement. These exchangers assure greater initial and operating economies with more cooling surface per unit volume. Young features include factors for fouling and safety, and provide an extra reserve capacity when conditions warrant. Tubes are readily accessible for cleaning. Available in wide range of sizes.

Put Young Talent to work for you . . .

Solving heat transfer problems is what we do best because it is our very reason for being. You, too, can harness the power of Young engineering talent. Write, wire or call without obligation.

Write to Dept. K-316 for Catalog No. 1155

Young RADIATOR COMPANY

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Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Matteson, Illinois

LITERATURE . . .

Pumps, Blowers, Compressors

Blowers.....Precision manufactured to move more gas or air with less wear than other blowers of equal size or weight . . . and with less maintenance and power costs. Describes line in detailed Bulletin B-154.
400 *Read Standard Corp.

Calculators, Vacuum Pump.....Stokes Vacuum Calculator contains valuable high vacuum data, simplifies calculation of pump performance and selection of pump size for specific applications. Available upon request.
72a *F. J. Stokes Corp.

Compressors.....For any volume . . . any pressure . . . any use . . . your Gardner-Denver Compressor specialist can fill your needs from firm's wide range of compressor types & sizes. Request Bulletins.
96 *Gardner-Denver Co.

Compressors, Centrifugal.....De Laval compressors are designed and built for heavy duty continuous operation. Rugged, horizontally split casings . . . individually designed impellers . . . etc. See Bulletin 0504.
339 *De Laval Steam Turbine Co.

Compressors, Oil-Free.....Joy WG-9 oil-free compressors are equipped with carbon graphite piston rings. Need no lubrication, and compensate automatically for wear. For further information, request Bulletin 104-11.
8 *Joy Mfg. Co.

Exhausters, Rubber-Lined....."Buffalo" rubber-lined exhausters last from 3 to 12 times longer than ordinary metal fans handling fumes containing corrosive materials. Furnishes details in Bulletin No. 2424-F.
82 *Buffalo Forge Co.

Fans.....The Series 106 fans feature: certified ratings, pressures to 18" w.g., volumes to 125,000 cfm., heavy construction, choice of 3 special-duty wheels, etc. Available in 16 sizes. Request Bulletin 5306-H.
60 *American Blower Corp.

Pumps.....Information on the number of rings, depth of box, type of packing . . . chemical & physical properties of fluid being pumped, speed of shaft & other usable facts, in Pump Bulletin No. S-147. Request your copy.
R453 *Taber Pump Co.

Pumps.....Company offers a bulletin covering the Dexter-Conde "Dri-Air" pump & Dexter-Conde air filters. Includes construction details, specifications, descriptive data, illustrations, applications, etc.
474A Dexter Folder Co.

Pumps.....If you have a problem where metering, blending or other accurate pumping of liquids is concerned, let Viking help solve it. Use Viking pumps for accurate pumping. Request information & Bulletin 568c.
TR467 *Viking Pump Co.

Pumps.....New illustrated bulletin describes Nuclear's "Canned" combined motor and pump, which requires no seal, no stuffing box, no lubrication. Includes specification, dimensions, & applications. Bulletin 1001.
474B Nuclear Pump.

Pumps, Acid.....80-gpm. centrifugal pump with hard rubber casing and impeller, Hastelloy C shaft. Handles nearly all corrosives. Mechanically simple, trouble-free. For information, request Bulletin CE-55.
385c *American Hard Rubber Co.

Pumps, Acid & Chemical.....Pumps to handle every acid or chemical fluid used in industry. Offers help with particularly difficult chemical pumping problems. For pertinent details, request Bulletin 203-7.
392 *Lawrence Pumps.

* From advertisement, this issue

"Buying on price alone is like marrying for beauty—regret is just a matter of time."

We consider ease of operation, maintenance, service and life of the valve equally important and engineer our valves in line with this thinking. That's why some of our valves have been in continual use for over 45 years and are still operating at peak performance!

Technical bulletins, describing each of our valves in detail, gladly sent on request.

GOLDEN ANDERSON Valve Specialty Company

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Designers and Manufacturers of VALVES FOR AUTOMATION

SAVE TIME· SAVE MONEY

STYLE SSP
No. 304 stainless steel plate welded to stainless steel hub, polished completely to "Dairy FINISH".

STYLE HX
No. 1010 steel plates welded to hexagon hub. Thoroughly suitable for all applications in which iron or cast steel propellers would otherwise be used.

with **MICHIGAN'S NEW** *and radically different* **"FABRICATED" PROPELLERS!**

NOW, for the first time in history, you can obtain "fabricated" propellers so accurately balanced and pitched they will do a perfect job of mixing, blending, stirring, pumping or aerating in any application requiring relatively low horsepower and not over 1750 RPM. Our very specialized, recently developed process of fabricating these wheels results in real cost-savings, considerably lower prices to our customers and far quicker deliveries. They are available in all standard sizes from 6" thru 24" diameters, right and left turning . . . in stainless steel polished to a "Dairy Finish" and 1010 Steel. If you are using wheels in these categories by all means investigate the new MICHIGAN FABRICATED PROPELLERS. It's bound to pay you big dividends in time and money savings. Write for your free copy of our new INDUSTRIAL PROPELLERS CATALOG.

MICHIGAN WHEEL CO.

GRAND RAPIDS 3, MICH.

FILTRATION NEWS

CROSS-SECTION through new white MICRO-KLEAN element. Graded density provides filiration in depth, gives longer life, more complete solid removal.

NEW 5-micron filter

Provides 50% longer service life, polishes, purifies liquids to sparkling clarity, handles highly alkaline fluids

Cuno's new white MICRO-KLEAN filter cartridge (No. 2278-B2) brings a new degree of clarity and purity to beverages and other fluids demanding the utmost in filtration.

It's guaranteed to remove 98% to 100% of particles larger than 5 microns on the first pass of fluid plus a large percentage of particles down to 1 micron in size.

And, the new cartridge, retaining the true graded density features of Cuno's MICRO-KLEAN cartridge, lasts up to 50% longer than previous cartridges on recommended applications.

White MICRO-KLEAN is made of cellulose fibres, firmly bonded together with a totally inert resin. There's no possibility of contaminating fluid with harmful or bad tasting substances. What's more, the rigid structure formed by the bonding material prevents rupturing, channeling or distortion of the filter element.

Write today for the complete story on this latest advance in fluid purification. The Cuno Engineering Corporation, 31-10 South Vine Street, Meriden, Connecticut. 6.5

CUNO ENGINEERED FILTRATION

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous stainless steel)

VISCOSITY*

*"That property of a body in virtue of which, when flow occurs inside it, forces arise in such a direction as to oppose the flow." — *Webster*

BROOKFIELD*

*Pioneer and world leader in the development and manufacture of precision viscosity instruments. Today, Brookfield is universally accepted as the World's *Standard for Viscosity Measurement and Control!*

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*A scientist interested in easy, accurate viscosity measurement or control for laboratory or production processes. You'll be happy to learn, too, that more than 300 technical articles and references based on Brookfield and viscosity measurement of 200 different materials have been published in the past ten years. You are welcome to any of this data which may pertain to viscosity measurement control problems you have.

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Brookfield

ENGINEERING LABORATORIES INCORPORATED

STOUGHTON 13, MASSACHUSETTS

LITERATURE . . .

Pumps, Centrifugal.....From impeller to shaft seal . . . Weinman pumps are built better. The built-in quality adds up to cost-saving, pumping efficiency for every job. Request descriptive product Bulletin.
396 *Weinman Pump Mfg. Co.

Pumps, Centrifugal.....Impervious graphite pumps feature mechanical seal with enclosed coolant, rugged type SN armored connections, interchangeable parts, wide capacity range, etc. Catalog Section S-7250.
337f *National Carbon Co.

Pumps, Centrifugal.....Standard, single stage, end suction, centrifugal process pumps . . . Series 10, 20 and 30 . . . for industrial, refinery and general service are described in a new, illustrated Circular No. 184B.
443 *Dean Bros. Pumps

Pumps, Centrifugal.....Easily adapt to changing conditions & demand, save power, combat corrosion & erosion. Speeds, 1750 & 3500 rpm; capacities to 600 gpm; heads to 300 ft. Request Bulletin P-3C for details.
387 *Ampco Metal.

Pumps, Centrifugal.....The Eastern D-11 is the smallest, close-coupled, single-stage centrifugal pump available with an induction type motor. Complete specifications on all Eastern centrifugal pumps in Bulletin 120-B.
447 *Eastern Industries.

Pumps, Centrifugal.....Illustrated reference describes line of SSV centrifugal pumps. Includes details of construction of the various sizes available, operating advantages for users, etc. Bulletin No. 107.
L451 *Frederick Iron & Steel.

Pumps, Chemical.....Available in sizes to handle up to 4,000 gpm at temperatures to 800 F. Feature Leakollector stuffing box gland and mechanical shaft seal. For complete information, request Bulletin No. 7095-A.
223 *Ingersoll-Rand.

Pumps, Chemical.....Offer new features that make them rugged, dependable, long-lived pumps for handling corrosive liquids. In 9 sizes providing capacities up to 720 gpm & heads up to 200 ft. Bulletin 725.4.
282 *Goulds Pumps.

Pumps, Chemical, Oil-Lubricated..... Recommended for pumping liquors, corrosive materials and solutions in the most used ratings to 3500 gpm, heads to 400 feet for liquids to 550 F. Request Bulletin 52B7638.
58 *Allis-Chalmers Mfg. Co.

Pumps, Chemical Process.....Type DL and Type DM chemical process pumps are available in discharge sizes from 1 inch through 4 inches, providing a range for most all chemical process applications. Bulletin B-1608.
476A Peerless Pump Div.

Pumps, Close-Coupled.....Feature the "Q" Factor . . . the built-in quality which provides trouble-free satisfaction and long life. Offers complete description of Class CCL close-coupled pumps in Bulletin 975.
410a *Buffalo Pumps.

Pumps, Diaphragm.....Cut operating and maintenance costs in handling corrosive, abrasive, viscous, heavy or delicate fluids. Positive, double reciprocal piston pump requiring no packings (no leakage). Bul. 137A.
439e *T. Shriver & Co.

Pumps, Diffusion & Booster.....Unsurpassed for through-put, blank off, and fore-pressure tolerance and reliability. Offer long, trouble-free life, and are easy to maintain. Product bulletin available upon request.
345b *National Research Corp.

Pumps, Direct Flow.....Simplicity of Aldrich Direct Flow design, with fluid-end sectionalization, offers substantial economies in operation and maintenance. Request condensed catalog and Data Sheet 100.
314 *Aldrich Pump Co.

* From advertisement, this issue

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LITERATURE . . .

Pumps, Double Suction.....Hydraulically balanced, highly efficient and durable. In sizes to deliver from 10 to 14,000 gpm for circulating, air conditioning, other plant services. Details in Bulletin 955-Q.
410b *Buffalo Pumps.

Pumps, General Purpose.....Designed for a broad range of clean liquid applications, these Roper Series 3600 Pumps are recognized for highly dependable performance, low maintenance characteristics. Request Catalog.
445 *Geo. D. Roper Corp.

Pumps, High Vacuum.....“Stokes Microvac Pumps for High Vacuum” tells the full story on Microvac design features—lists all models—demonstrates applications—explains how to calculate performance. Catalog No. 700.
72b *F. J. Stokes Corp.

Pumps, Mechanical.....Pumps feature Gas Ballast . . . maintain original high efficiency even when pumping 100% water, or other condensable vapors. Costly oil purifiers, frequent oil changes unnecessary. Bulletin.
345a *National Research Corp.

Pumps, Paper Stock.....For handling high consistency liquids—save money and trouble with non-clogging paper stock pumps. Available in alloys or rubber-lined for corrosive and abrasive liquids. Bulletin No. 953.
410d *Buffalo Pumps.

Pumps, Positive Displacement.....Designed with the spring-loaded, John Crane rotary seal, they are recommended for non-abrasive products having corrosive properties. Request complete product details.
300 *Waukesha Foundry Co.

Pumps, Process.....Peerless type DL & DM chemical process pumps feature: accessibility, durability, serviceability, interchangeability, reliability and availability. For complete details, see Bulletin B-1608.
165 *Peerless Pump Div.

Pumps, Sanitary.....New XB-SAN series of Sani-Flex Sanitary pump units for handling food products, pharmaceuticals, corrosive solutions & abrasive slurries, announced by Vanton Pump. Request literature.
245 *Cooper Alloy Corp.

Pumps, Sump.....Three advantages are featured in the “Buffalo” sump pump; easy installation; always in prime (since there is no suction lift); & simplified maintenance. For details, request Bulletin No. 963-F.
410e *Buffalo Pumps.

Pumps, Turbine.....Describes the water & oil lubricated Layne vertical turbine pumps, their application, & pump drive heads designed for water wells serving industry, municipality & agriculture. Bulletin WO-53.
477A Layne & Bowler.

Services, Processes, Misc.

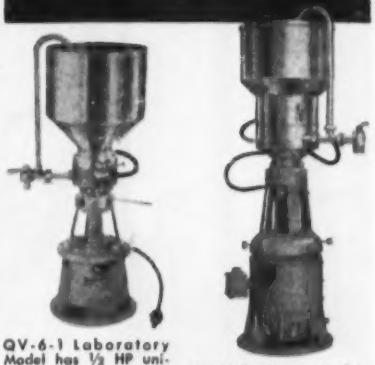
Air Recovery & Purification.....Company offers bulletin describing air contamination, air recovery, recovery method, installation, capacity and air recovery service. Also includes specifications for equipment.
477B Norkem Yakima.

Design & Engineering, Ammonia Plants.....Specialized know-how embraces all phases of process and equipment design, fabrication and erection. For complete information the company makes available Bulletin 0-54-1.
126 *Foster Wheeler.

Doors, Quick Opening.....Struthers Wells quick opening doors furnish the means for complete automation . . . the results of advanced engineering achievements. For complete details, see Bulletin SW-553.
59 *Struthers Wells Corp.

* From advertisement, this issue

how to pick a COLLOID MILL



QV-6-1 Laboratory Model has ½ HP universal motor with 5 gal. stainless steel jacketed hopper or pressure head for direct feed.

VT-11 Production Model has 15 or 20 HP motor with 20 gal. stainless steel jacketed hopper.

Picking the proper colloid mill—for the best possible results in grinding, emulsifying and homogenizing—isn't always easy. For most colloid mills are “look-alikes”—on the *outside*.

But if you stripped a *G-W Eppenbach Colloid Mill* down, you'd see fundamental differences—like the calibrated micrometer adjustment that assures accurate clearances between rotor and stator (which can be reproduced *exactly* at any time) . . . the by-pass assembly that recirculates material until ready for discharge . . . the *tangential* discharge outlet that allows material to flow out rapidly at a natural angle, for maximum production . . . the safety stop studs for protection of the rotor-stator at small gap settings . . . the component design of rotor-stator . . . and many other quality features.

In addition, any laboratory, pilot plant, or production model with the standard, open, gravity fed hopper can easily be transferred into a unit suitable for continuous flow operations by interchanging the hopper with the pressure head assembly shown below.

All these features make the easy-to-use, easy-to-clean, easy-to-install Eppenbach Colloid Mill an exceptional long-term investment in service, economy and efficiency. Write for our new catalog.

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Eppenbach Division, Dept E-10
420 Lexington Ave., New York 17, N. Y.

Yes, please, send me your new Eppenbach Catalog.

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"This Scale Check Chart showed us how to get Better Cost Control"

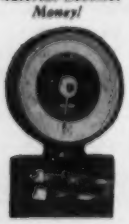
It's New from TOLEDO— send for yours today!

Your scales are a vital element in effective cost and quality control. Errors in weighing go all the way through accounting and affect cost . . . profit . . . or loss! You need to look at *all* your weighing today . . . not as isolated scales, but as a *weighing system.*

Toledo's new Scale Check Chart will show you quickly and accurately how well your scales are serving you, and provide the information you need for truly effective cost control.

This new Check Chart is yours for the asking in a handy kit that contains all you need for an easy, informative appraisal of weighing in your plant. Send for it today. Address Toledo Scale Company, 1403 Telegraph Rd., Toledo 1, Ohio.

On Your Scales . . . Material Becomes Money!



TOLEDO®
HEADQUARTERS FOR SCALES

LITERATURE . . .

Face Shields.....Cesco 770 Face Shield comes in 3 window lengths—4", 6" and 8". Also offer snap-fast face shield with deflector crown, helmet-type face shield, spark shield, etc. Details in comprehensive catalog.
478A Chicago Eye Shield Co.

Fire Protection.....28 p. covers various methods of fire detection, fire prevention, fire control and fire extinguishment associated with the field of "Special Hazard" fire protection. Fully illustrated Catalog 74.
478B "Automatic" Sprinkler Corp.

Flotation.....More large plants are installing "Sub-A's" for entire flotation job, because they give maximum recovery at a low cost per ton. Dependable, simplified continuous operating. Bulletin No. F10-B81.
388g *Denver Equipment Co.

Grating & Stair Treads.....Blaw-Knox electroforged steel grating makes every step a safe step indoors or outdoors. Makes available new reference & quotations. For more information request Bulletin 2486.
454 *Blaw-Knox Co.

Laboratory Equipment.....Batch and continuous test models of crushers, screens, ball mills, pulverizers, rod mills, classifiers, agitators and mixers, pulp distributors, feeders, etc. Data in Bulletin LG3-B10.
388i *Denver Equipment Co.

Laboratory Equipment & Furniture..... Line of sectional units designed for interchangeability & flexibility assures a synchronized installation which will produce peak efficiency. 180 p. Catalog 4B & Supplement 55-A.
B483 *Metalab Equipment Corp.

Laboratory Equipment & Furniture..... Company makes available a catalog describing its line of top-quality tables, cases, cabinets, fume hoods & radio chemical lab equipment. For details, request Catalog.
TL467 *Duralab Equipment Corp.

Lubricators.....New 2 color 2 p. service instruction sheet gives detailed service instructions & operating information on high capacity spring discharge piston pump lubricators. Designated as Type D Lubricators.
478C Bijur Lubricating Corp.

Photocopying Machines.....Company offers new case history brochure on the use of a Rectigraph photocopying machine. Describes how it speeds paperwork, eliminates errors, & cuts costs on reports of all kinds, etc.
478D Haloid Co.

Plant Sites.....Data on raw materials, transportation, power and fuel, markets, labor, facilities, sites, community services, laws and regulations, etc. Also includes physical map, "Industrial Location Services."
R473 *N. Y. State Dept. of Com.

Plates, Abrasive.....Non-skid abrasive aluminum tread plate provides sure footing even when covered with oil, grease or water. It is durable and corrosion-resistant. Request booklet for complete details.
478E Aluminum Co. of America.

Reproduction Materials.....Kodagraph reproduction materials for new techniques . . . new savings . . . new standards of quality—in drawing and document reproduction. Request new booklet on Kodagraph materials.
101 *Eastman Kodak Co.

Solvent Recovery.....Valuable 32 p. illustrated catalog describes "Columbia" Activated Carbon System of Solvent Recovery, including equipment, application, typical solvents & operation cost. Catalog F-4410D.
478F Carbide & Carbon Chem. Co.

Windstorm Damage Prevention.....New 40 p. technical publication describes how to prevent windstorm damage & help to save lives & property. A timely source of information on tornadoes, hurricanes, & other severe storms.
478G Nat'l. Bd. of Fire Underwriters.

* From advertisement, this issue

If you're not in the book *you're a man without*

. . . . . a country
. . . . . a state
. . . . . a county
. . . . . a town
. . . . . a party
. . . . . a street
. . . . . a school
. . . . . a *vote*

Look at all the things you can lose, if you're not a registered voter.

If you're not in the book, you lock yourself out of the elections. The polls are closed to you. You can't vote on streets, or schools, councilman or mayor (not to mention congressman, senator or president). You don't even have the right to *complain* about your government and the way things are run!

But more than that, you cut yourself apart from your neighbor next door, your friends at the shop, your fellow members in union or club.

You lose the right to look that boy of yours in the eye when he wants to know if you're doing your part.

And you lose the self-respect that comes from knowing you can walk into the polls on Election Day—the one place in the world where all free men are really equal. Isn't it too much to risk for the little time that registering takes?

Get your name in the book
—and do it now!

Is your name in the book?

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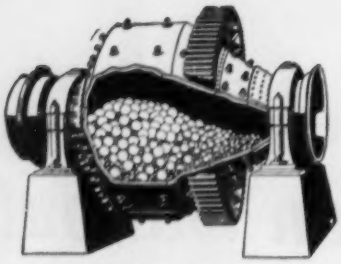
for every application . . .



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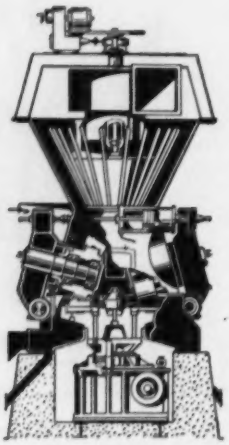

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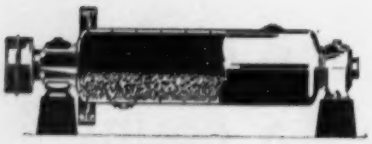

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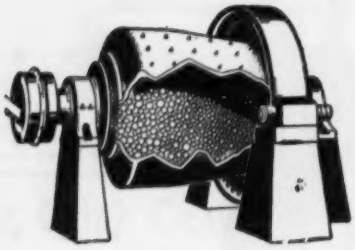

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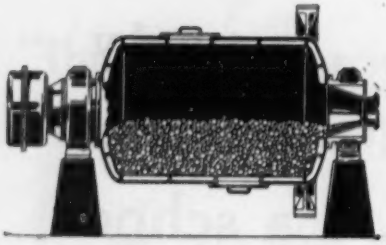

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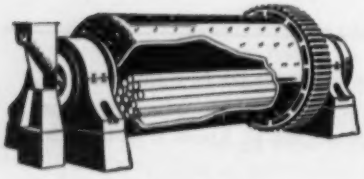

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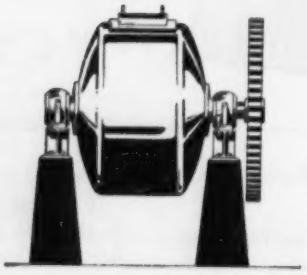

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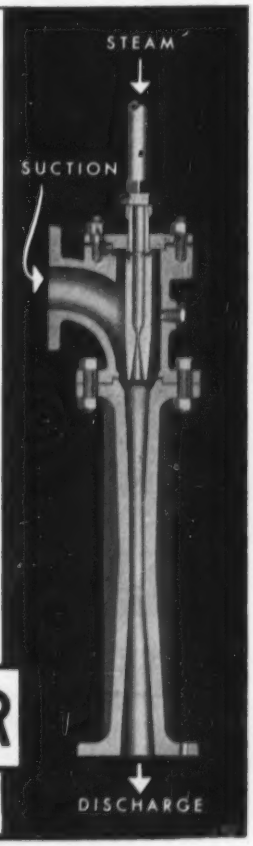

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MARSH
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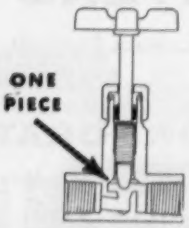
MAXIMUM WORKING PRESSURE 10,000 PSI

. . . for finer regulation of water, oil or gas

First needle valve to combine all the characteristics called for in modern industry. Embodies sturdiest basic construction—machined from solid bar stock—suitable for pressures to 10,000 psi and equally efficient in lower range. Note stem guide fused to body by new "Conoweld" process, eliminating faults of conventional two-piece valves. Stem 416 stainless steel. Stem threads fine pitch for strength and micrometer regulation. Body electro-zinc plated. Sizes ⅛" to 1", globe and angle patterns.



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MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corp.* Dept. 24. Skokie, Ill.
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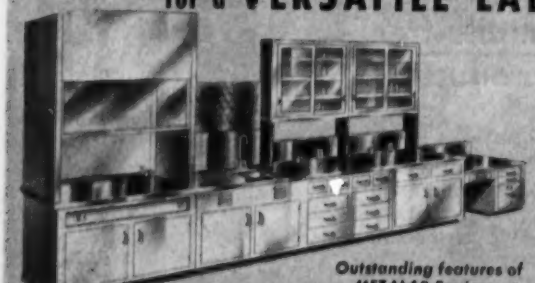
for a VERSATILE LABORATORY



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- Exclusive 5-point METCOTE protection throughout.
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The equipment shown here features entire units and illustrates METALAB precision engineered interchangeable type construction.

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FLOW TUBES

are impact-type head meters or differential producers.

They are designed to give you guaranteed high accuracy with lowest head loss.

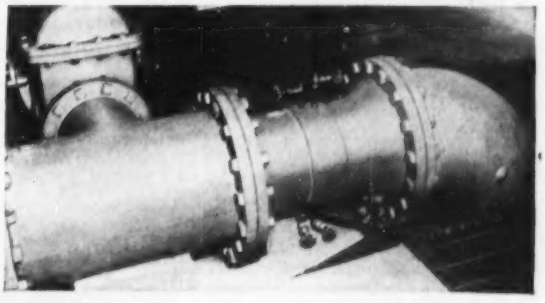
*Gen-Ti-ly

You also get:

LOW FIRST COST—Gentile Flow Tubes are economical to purchase.

LOW OPERATING COST—Gentile Flow Tubes require minimum maintenance. Where purging or back-flushing is a normal routine, the Gentile Flow Tube can be arranged for constant or intermittent purging without removing from the line.

LOW INSTALLATION COST—Gentile Flow Tubes can be installed with no straight run upstream or downstream, except where near valves or regulators.



Actual installation of a 16" Flow Tube for REVERSE FLOW. Note fittings (elbow and tee) are bolted directly to flanges of Flow Tube.

Gentile Flow Tubes can be furnished with or without suitable secondary indicating, recording, or totalizing instruments.

GENTILE Flow tubes are manufactured exclusively by Foster Engineering Company

Write for further information or specific recommendations.

FOSTER ENGINEERING COMPANY

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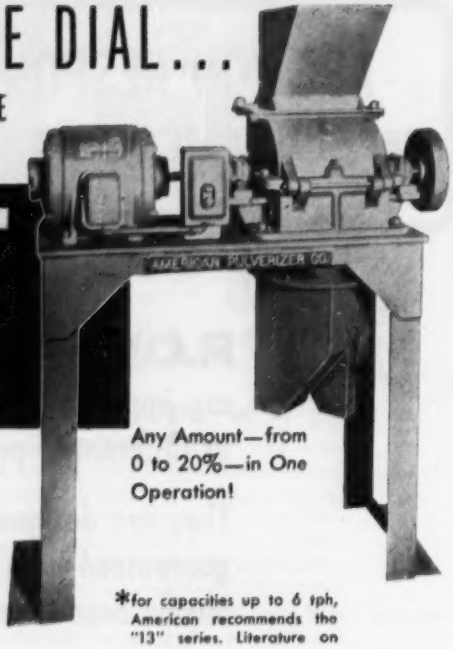
AUTOMATIC VALVES • CONTROL VALVES • SAFETY VALVES • FLOW TUBES

JUST SET THE DIAL...

FOR A REPRESENTATIVE SAMPLE OF A SAMPLE

AMERICAN SAMPLE CRUSHER

WITH NEW ADJUSTABLE SAMPLING HOPPER



Any Amount—from 0 to 20%—in One Operation!

Does the job so quickly, efficiently, there's no loss of moisture content in sample.

FAST Up to 1 tph (Model 15 x 9); ½ tph for Model 9x9 (shown).*

EFFICIENT Once-through and the job's done!

LOW COST Practically no wear to an American Sample Crusher.

*for capacities up to 6 tph, American recommends the "13" series. Literature on request.

American PULVERIZER COMPANY

Designers and Manufacturers of Ring Crushers and Pulverizers

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- Easy To Read Scales
- Unusually Long Life
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- No Outgassing Or System Contamination

NEW MODEL LV-1. Measures 0-100 micron Hg. Single meter; large 4" scale indicates vacuum directly without adjustments. Internal voltage regulator takes care of fluctuations in line voltage. Ideal for Industrial Installations. Also available in 0-1000 micron and 0 1-20 mm Hg. ranges.

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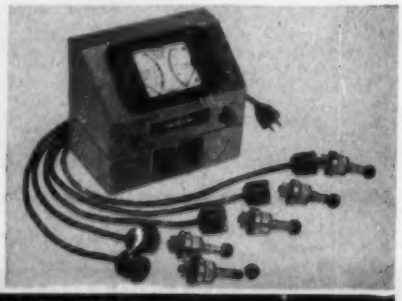
(Shown at right with optional 5-position switching attachment) Range from 0-1000 microns Hg. Manual current set and additional milliampere scale allow adjustment for use in presence of gases other than air, for leak detection, and for specialized laboratory use.



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of Hastings Gauges

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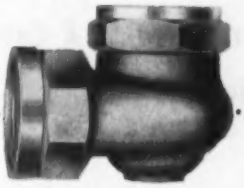

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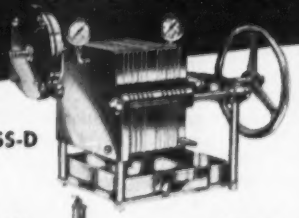

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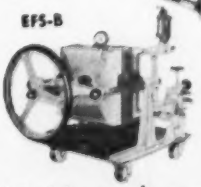

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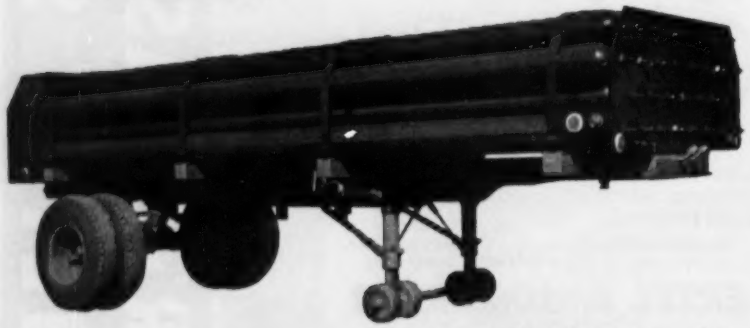

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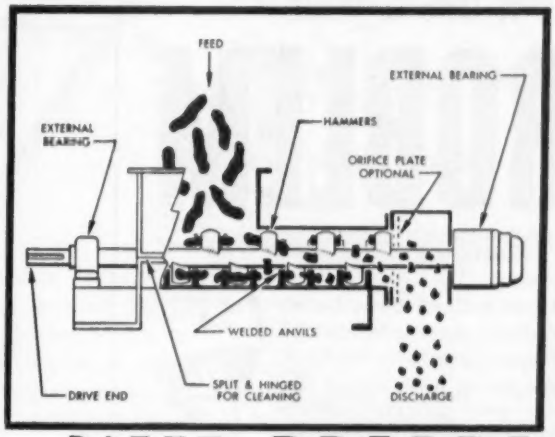

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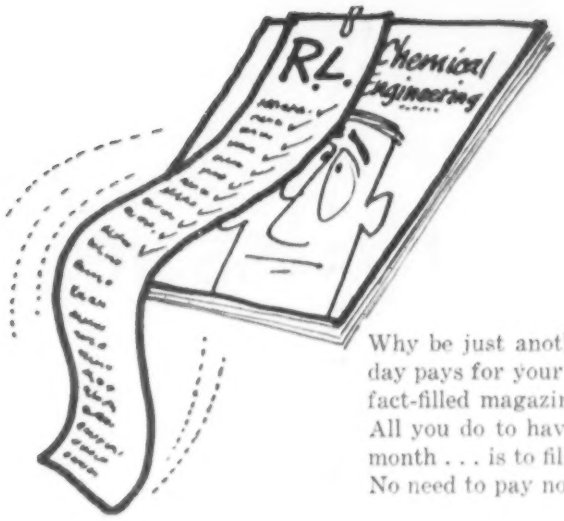

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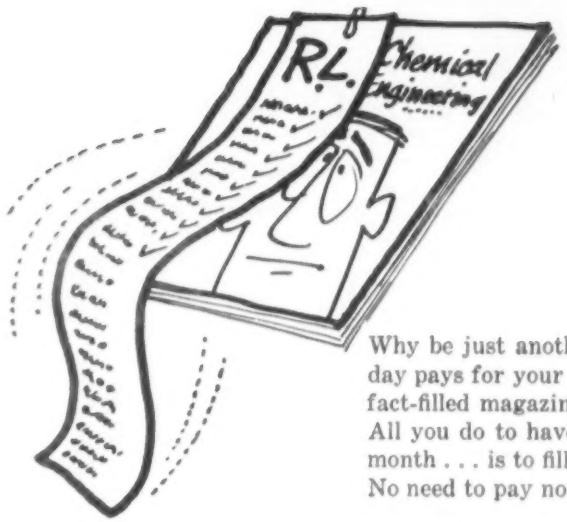

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42-3d	78	139a	162	250B	267	318	355-6j	388b	441	450C	456D	461F	468C	480c
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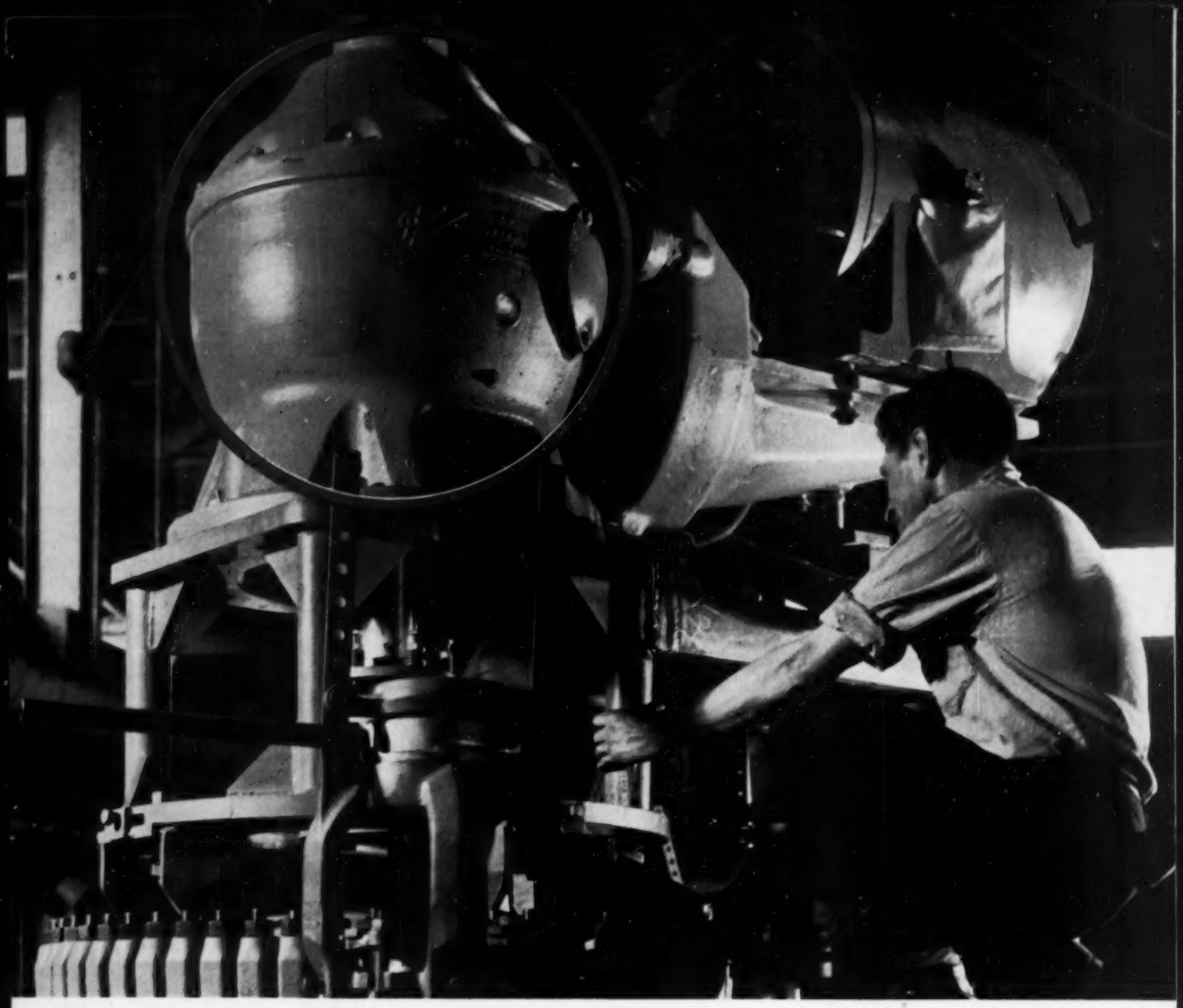

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